2024 Atlantic Coast Conference Meeting of the Minds Presentation Abstracts

Welcome to the University of Notre Dame, where we come together to celebrate the 18th Annual ACC Meeting of the Minds! In this document, you will find the full schedule of student presentations and submitted abstracts, the conference schedule at a glance, and more information about the weekend of events. You can also visit our website at https://motm2024conference.nd.edu/ for more information.

Schedule at a Glance

Saturday, Apr 6, 2024

8:30 - 9:00 am	Welcome Address	Morris Inn, Smith Ballroom AB

Featuring Dr. **Erin Klawitter**, Assistant Vice President, Undergraduate Education

9:15 - 10:15 am	Oral Session 1	McKenna Hall & The Morris Inn
Identity & Culture		**McKenna Hall, Room 202**
Lina Abdellatif	University of Notre Dame	Advantageous Marginality: How Islam Promoted Reconciliation and Peacebuilding in Rwanda
Thang Lian	Duke University	Even in Grief, We Remain Beautiful: Chin Refugees' Reflections and Lamentations on Grief
Kiran Soma	North Carolina State University	What We Grew Up With: Exploring Identity Through Narrative Representations
Anxiety, Fear, & Mental Health		**McKenna Hall, Room B01**
Grace Drolet	Clemson University	Psychological Dread and Extreme Persistent Fear
Priya Gupta	University of Pittsburgh	From Resource Scarcity to Psychological Toll: Challenges Faced by Mental Health Crisis Workers
Frances Grace Hart	Boston College	Development and validation of an interpretation bias measure for death anxiety

9:15 - 10:15 am	Oral Session 1	McKenna Hall & The Morris Inn
Nuclear & Biomedical Engr.		McKenna Hall, Room B02
Camden Eck	Georgia Institute of Technology	Design and Simulation of a Nuclear Thermal Propulsion Rocket Engine
Sarah Paguaga	Clemson University	An Atomistic Study of the Radiation Resistance of Grain Boundaries in High Entropy Alloys
Katie Taran	North Carolina State University	The Effect of Brachial Plexus Birth Injury on Bone Growth
Gut & Reproductive Health		Morris Inn, Hesburgh Room
David Beck	Virginia Polytechnic Institute and State University	Embryonic Heat Exposure Leads to Greater Stress Resiliency Later in Life: Molecular and Morphological Mechanisms in the Gut
Sarah Broyhill	University of North Carolina at Chapel Hill	Development of a Three-Dimensional Endometrial Model to Examine Factors Affecting Endometrial Function
Alexys King	Clemson University	Host-Microbe Interactions: Interactions and Manipulations of Bacteroides in the Gut Microbiome
10:15 - 10:30	Break	

10:30 - 11:45 am	Poster Session 1	Morris Inn, Salon Smith Ballroom B
Dylan Amiri	University of Miami	Revealing Inconsistencies Between Epworth Scores and Apnea-Hypopnea Index when Evaluating OSA Severity
Sasha Bacot	Duke University	Mitochondrial Responses to mtDNA Damage: Mitophagy and Extracellular mtDNA Release
Abby Cortez	Duke University	Investigating the Right Open Reading Frame Kinase - Nuclear Factor Kappa-light-chain-enhancer Interaction in Prostate Cancer
Tucker Cribb	Clemson University	Wild Hogs on the Clemson Experimental Forest: Radio/GPS tracking invasive wild hogs in Clemson
Anna Davis	Boston College	Protecting Endangered Species in the US: A Historical Analysis of Reactive Environmental Law and Public Resistance
Beatriz de Campos Silva	University of Notre Dame	Exploring the Effects of Plasma Radiation on the pH of Solutions for Potential Medical Applications
Jack Engel	University of Virginia	Allele-Specific Splicing Analysis in Mus musculus and Mus spretus through utilization of F1 Dihybrid Crosses
Reshma Goud	North Carolina State University	Completing the Puzzle: Genome Sequencing of Tomato Lanai

10:30 - 11:45 am	Poster Session 1	Morris Inn, Salon Smith Ballroom B
Katherine Harland	Clemson University	In-Tact | Textiles and Tactile Architecture in a Post-Pandemic World
Divya Iyer	Georgia Institute of Technology	Electropolymerization as a Method to Create Irreversible Electrochromic Indicators
Aaron Lener	Syracuse University	Description and analysis of Jarawan negation
Thomas Lu	Virginia Polytechnic Institute and State University	Development of Robotic Histotripsy Systems for the Precise, Complete, and Non-invasive Ablation of Osteosarcoma Tumors
Elizabeth Mills	University of Virginia	Using Microfluidics and Agent-Based Modeling to Evaluate the Role of Porous Media in Chemotactic Migration
Romith Paily	University of Louisville	Disposable E-Cigarettes Evoke Arrhythmias Dependent on Flavors
Alivia Pierce	University of Pittsburgh	Capturing the Black Struggle for Visibility Through the Vietnam War
Allison Portaro	University of Louisville	Assessing the Bioactivity of Salvia Phytochemicals Against Breast Cancers
Adriana Retamales	University of North Carolina at Chapel Hill	Elucidating the Molecular Interactions that Mediate Lipid Nanoparticle Delivery of mRNA Into Immune Cells
Melisa Sencer	Florida State University	Single Cell Analysis of Circuit Deficits in Fragile X Syndrome
Monica Soni	Wake Forest University	What Does College Have to Do With it? Emerging Adults' Responses to the Crises of 2020

11:45 - 1:00 pm	Lunch	Morris Inn, Smith Ballroom AB

1:15 - 2:15 pm	Oral Session 2	McKenna Hall & The Morris Inn
Historical Perspectives on Conflict		**McKenna Hall, Room 202**
Brendan Mahoney	Boston College	Iraq as a Continuation of Vietnam: The Aging New Left and the War on Terror
Dane Sherman	University of Notre Dame	Absolution for Empire: Military Chaplains During the First Gulf War (1990-1991) Caught Between Duty for the State and Duty Towards the Church
Biology in Medicine		**McKenna Hall, Room B01**
Sophia Dhrolia	University of North Carolina at Chapel Hill	Evaluation of Crosstalk between the Intrinsic and Extrinsic Pathways of Coagulation
Madison Howard	Wake Forest University	Weighted Vest Use to Mitigate Weight Loss-Associated Bone Loss in Older Adults: Process Measures from the INVEST in Bone Health Randomized Clinical Trial
Neharika Murthy	University of Pittsburgh	The Impact of CREBRF Overexpression in Hypothalamic AgRP and POMC Neurons on Energy Homeostasis

1:15 - 2:15 pm	Oral Session 2	McKenna Hall & The Morris Inn
Smart Technology		McKenna Hall, Room B02
Katherine Hill	University of Notre Dame	Leveraging Wearable Technology for Digital Gunshot Detection: An Exploratory Study
Zikang Lang	Georgia Institute of Technology	Generating Virtual On-body Accelerometer Data from Virtual Textual Descriptions for Human Activity Recognition
International Affairs, Language, & Math Education		Morris Inn, Hesburgh Room
Harrison Betz	Florida State University	Adapting the Afterlife: Latin American Reimaginings of Dante's "Inferno"
Kaylin Nolan	Georgia Institute of Technology	Addressing Multidisciplinary Challenges with Complex Adaptive Systems Theory
Hanyi Xu	Syracuse University	Making Mathematics Meaningful: A Mixed-Methods Study of Undergraduate Students' Learning through Social Justice

1:15 - 2:15 pm	Oral Session 2	McKenna Hall & The Morris Inn
Oceanic Discoveries		Morris Inn, Carmichael Room
John Hinkle	University of North Carolina at Chapel Hill	A PCR-based survey of methane-cycling archaea in methane-soaked subsurface sediments of Guaymas Basin
Shara Sookhoo	University of Miami	Coral Microbiome Distribution and Dynamics at the Cellular Level
Erin Tilly	Florida State University	Assessing oyster reef condition: do characteristics of oyster clusters and sediments tell the same story?

2:15 - 2:30 pm	Break	

2:30 - 3:45 pm	Poster Session 2	Morris Inn, Salon Smith Ballroom B
Kyle Adams	Wake Forest University	Quantification of Adenine During S-Adenosyl-L-Methionine-Dependent DNA Methylation
Isabella Cozzone	University of Miami	Angiogenic Biomaterials for Stem Cell Transplantation
Ava Davis	University of North Carolina at Chapel Hill	NRVR - Neural in the Virtual
Connor Diaz	University of Pittsburgh	How the Five Tribes Became “Red”: The Failure of Acculturation in the Indian Territory, 1830-1861

2:30 - 3:45 pm	Poster Session 2	Morris Inn, Salon Smith Ballroom B
Maddie Ferguson	Virginia Polytechnic Institute and State University	Iron-sulfur Cluster Assembling Thioredoxin from Methanocaldococcus jannaschii
Daniel Griffiths	Syracuse University	Predicting Injuries through Pose Estimation: A Biomechanical Analysis of Fatigue in Track and Field Athletes
Crystal Guerrero	University of Virginia	An Exploration of How Gut Microbiota Influences Early Life Neurogenesis in Drosophila Melanogaster
Richard Hilpert	Florida State University	Patterns of Hallucinogen Use Among Individuals with Social Anxiety Disorder
Sarah Jenison	Georgia Institute of Technology	Generating Multilayer Polyelectrolyte Coating Libraries on Protein Nanoparticles for Mucosal Delivery
Zachary Joseph	University of Notre Dame	The Role of the CXCL13-CXCR5 Chemokine Axis in Regulatory CD8 T Cell Trafficking
Melina Lavarone	Syracuse University	Gender Disparities in Depression: Reviewing the Sociocultural Contributions in Working Women's Mental Health Struggle
Divya Patel	University of Louisville	An Analysis of Active Galactic Nuclei in Diverse Galactic Environments
Aidan Scott-VanDeusen	University of Miami	Wireless Non-invasive Activation of Action Potentials With Magnetoelectric Nanoparticles

2:30 - 3:45 pm	Poster Session 2	Morris Inn, Salon Smith Ballroom B
Justice Skinner	North Carolina State University	Insights from Animal-Associated Bacteria in New York African Burial Ground Samples
Lara Thomas	University of Louisville	First-Year Engineering Students and GenAI: Experience, Attitudes, Trust, and Ethics
Tanya Upadhyay	North Carolina State University	Recapitulating the Microenvironment of the Heart using Decellularized Extracellular Matrix
Rongwei Zhu	Boston College	Escaping the Vietnam Quagmire: Johnson, Nixon, and America's Rough Road to Paris

3:45 - 4:00 pm	Break	

4:00 - 5:00 pm	Oral Session 3	McKenna Hall & The Morris Inn
Cellular Exploration		McHenna Hall, Room 202
Steven Cayea	Wake Forest University	Functional investigation of a bacterial fusion protein
Elijah Springer	Syracuse University	Characterization of Rab34 across cell types and cell cycle stages
Preeti Tanwani	University of Louisville	Understanding Mechanisms of Cancer Cell Killing by Novel Copper Containing Complexes

4:00 - 5:00 pm	Oral Session 3	McKenna Hall & The Morris Inn
Neuroscience & Development		**McHenna Hall, Room B01**
Michelle Chung	University of Pittsburgh	Association Between Area Deprivation Index and Outcomes After Subarachnoid Hemorrhage
Julia Davis	Duke University	The Influence of Harsh Parenting and Maternal Depression on Executive Function in Early Childhood
Trisha Maheshwari	University of Virginia	Are Dads Necessary? The Father's Role in the Development of Offspring Behavior
Music & Narrative		**McHenna Hall, Room B02**
Kathleen Hammock	University of Virginia	Ready When You Are: An Autobiographical Concept Album
Juan Londono	Wake Forest University	Soundscapes throughout Madrid, capital of the Kingdom of Spain
Trisha Santanam	Duke University	Sonic Curation and Blues Aesthetics in American Plays

4:00 - 5:00 pm	Oral Session 3	McKenna Hall & The Morris Inn
Science in Nature		Morris Inn, Hesburgh Room
Enma Navarro	Virginia Polytechnic Institute and State University	Designing in Harmony with Nature, Synthesizing Two Sustainable Land Management Strategies: Agroforestry & BioGeometry
Nicole Odibo	Virginia Polytechnic Institute and State University	Development of a Surface-Enhanced Raman Scattering (SERS) based Nanoprobe for Leaf pH Detection
Joelyz Wolcott	Florida State University	The effect of minocycline and oxytocin on lipopolysaccharide-altered anxiety-like and social affiliative behaviors in the male prairie vole
5:00 - 6:30 pm	Break	
6:30 - 9:00 pm	Reception and Banquet	Morris Inn, Salon Smith Ballroom AB

Featuring Keynote Address by Dr. Jeffrey Rhoads, Vice President for Research

2024 ACC Meeting of the Minds

Welcome and Keynote Addresses

Dr. Erin Klawitter, Assistant Vice President, Office of Undergraduate Education

Erin Klawitter serves as assistant vice president in the Office of Undergraduate Education. Among other responsibilities, she coordinates campus-wide efforts to ensure that every student has the chance to flourish at Notre Dame, particularly those from under-resourced educational systems and backgrounds. She also supports the Vice President and Associate Provost for Undergraduate Education in strategic planning, operational implementation, and fundraising efforts that impact the various programs and units housed in the Office.

Prior to joining Undergraduate Education, Klawitter was Managing Director of the Notre Dame - IBM Technology Ethics Lab and Associate Professor of the Practice in the Notre Dame Technology Ethics Center. In this role, she partnered with IBM to plan and execute research efforts concerning the ethical use of artificial intelligence, managed the Lab's budget and planning efforts, and supervised Lab staff. She also taught an undergraduate writing-intensive course concerning digital divides and algorithmic literacy. Klawitter has previously served the University as associate director of the Notre Dame Scholars' Program, as its inaugural content strategist, and as an undergraduate admissions counselor.

Klawitter graduated magna cum laude from Notre Dame's Program of Liberal Studies, which awarded her the Otto J. Bird award for best senior essay. She received her M.A. in Communication from Saint Louis University and her Ph.D. in Media, Technology, and Society from Northwestern University. Her award-winning and published research focuses on the relationship between social inequality, Internet participation, and differences in health and economic outcomes. A former Jesuit Volunteer, Klawitter spent the year immediately following her Notre Dame graduation in Anchorage, AK, where she accompanied clients experiencing homelessness.

Dr. Jeffrey Rhoads, Vice President for Research

Jeffrey F. (Jeff) Rhoads was appointed vice president for research in 2023. In this role, he has oversight for all of Notre Dame's research infrastructure, including supporting programs in all areas of research, scholarship and creative endeavor. He also holds the position of professor of aerospace and mechanical engineering.

Prior to joining Notre Dame, Rhoads served as executive director of the Purdue Institute for National Security and as a professor in the School of Mechanical Engineering. He previously served as the director of the Ray W. Herrick Laboratories, associate director of the Purdue Energetics Research Center, and director of practice for the Mechanical Engineering Education Research Center at Purdue University.

Rhoads is a fellow of the American Society of Mechanical Engineers and a member of the American Society for Engineering Education and the National Defense Industrial Association. Rhoads earned a bachelor's degree, a master's degree, and a doctoral degree, each in mechanical engineering, from Michigan State University.

Oral Session 1

Identity & Culture	9:15 - 10:15 am	McKenna Hall, Room 202

Advantageous Marginality: How Islam Promoted Reconciliation and Peacebuilding in Rwanda

Lina Abdellatif
University of Notre Dame
Sociology, Peace Studies
Research Faculty Mentor: Dr. Rashied Omar, Kroc Institute for International Peace Studies, University of Notre Dame

Understanding the different lenses and orientations guiding different religious institutions helps assess what a productive relationship between religion and state looks like. The Catholic Church, heavily implicated in the 1994 Rwandan Genocide against the Tutsi, reinforced colonial durabilities through state-sponsored violence. While Western epistemes reconfigured the role of state and religion to promote genocidal ideology, the historically marginalized Rwandan Muslim Community defied the state's call for genocide. Using a polycentric case study of religion and state violence during the Rwandan Genocide, this paper explores how Islam in Rwanda emphasized a peripheral lens towards religion and justice, promoting peacebuilding through a subaltern and liberation theological standpoint. Following the relationship each religious institution had to the state structure pre and post-genocide, I discuss how religious perspectives coming from the periphery–such as the Muslim Community in Rwanda–best combat colonial durabilities and Western epistemes to bring long-term economic, social, and political reconciliation to Rwandans. This understanding, which I will define as advantageous marginality, is crucial for post-conflict societies harmed by religious violence.

Operating from the vantage point of the periphery not only identifies conditions for religious extremism and violence, but it can also address the structural vulnerabilities promoting violence through state and religious actors. This paper aims to contribute to the limited discourse on Islam on peacebuilding, as well as evaluate the effectiveness of a polycentric relationship between the state, religion, and civil society.

Even in Grief, We Remain Beautiful: Chin Refugees' Reflections and Lamentations on Grief

Thang Lian
Duke University
History
Research Faculty Mentor: Dr. Calvin Cheung-Miaw, History, Duke University

At once a theoretical reflection and lamentation, this essay weaves together the Chin people's transnational history, the author's personal narratives, and oral histories conducted with the author's mother and father to unravel the question, "How do Chin people grieve?" How does grief speak about the Chin people's relationships to lai tlang (Chin State)? How does grief speak into the silences of the Chin diaspora's experiences as refugees? In so doing, this essay reflects on the Chin refugee's politics of grief, arguing that the Chin diaspora's processes of communal grieving and mourning provide a powerful framework that situates the collective before the individual—a practice, the author elucidates, rooted in the Chin people's history as storytellers. Emerging out of the author's lamentations amidst the ongoing dispossession and murder of the Chin people, this essay ultimately seeks to articulate and explore grief to make sense of the senseless: refugeehood, displacement, resettlement, and military and state violence. Grief haunts but, as this essay demonstrates, it also creates hallowed spaces for communal mourning where people speak and act out their deepest love for one another.

What We Grew Up With: Exploring Identity Through Narrative Representations

Kiran Soma
North Carolina State University
Communication Media
Research Faculty Mentor: Mia Self, University Theatre, Arts NC State, NC State University

Research Collaborators:

A one-act play developed over fourteen months, What We Grew Up With guides audiences through a lifetime of Indian-American experiences in a span of sixty minutes. The play was selected as the winner of the 2023 Creative Artist Award in Theatre at NC State, resulting in an intensive workshopping cycle, a series of read-throughs, and on-stage performances. The writer identified the following as key purposes for the work: gaining familiarity with the stage play production process, cultivating identity through artistic expression, and utilizing storytelling as a vessel for positive change. At first glance, What We Grew Up With serves as a literary basis for discourse on contemporary issues, including racism and xenophobia. However, the play relies on a web of interpersonal relationships and generational discrepancies to anchor these topics in an engaging and sentimental narrative. Thus, What We Grew Up With opens windows into different pockets of time for an assemblage of characters who not only reflect the writer but also others who look like him. The exercise of creative writing and narrative building allowed the writer to critically engage with his background and identities. As he pulled elements from both, the play came to not only represent past events but also visions of the future, leaving viewers with a foundation for deeper conversations.

Anxiety, Fear, & Mental Health	9:15 - 10:15 am	McKenna Hall, Room B01

Psychological Dread and Extreme Persistent Fear

Grace Drolet
Clemson University
Psychology
Research Faculty Mentor: Dr. Robin M. Kowalski, Department of Psychology, Clemson University

Research Collaborators: Robin M. Kowalski, Clemson University, Department of Psychology
Madalynne Gagne, Clemson University, Department of Psychology
Kaitlyn Burzin, Clemson University, Department of Psychology
Hailey Carroll, Clemson University, Department of Psychology
Hannah Korson, Clemson University, Department of Psychology
Blake Rimmer, Clemson University, Department of Psychology
Emma Aurilio, Clemson University, Department of Psychology
Raquel Bunche, Clemson University, Department of Psychology
Gabriela Mochizuki, Clemson University, Department of Psychology
Natalie Cote, Clemson University, Department of Psychology
Morgan Dowd, Clemson University, Department of Psychology
Lyndsey Brewer, Clemson University, Department of Psychology
Kelly Evans, Clemson University, Department of Psychology
Aspen Ridder, Clemson University, Department of Psychology

Psychological dread is a phenomenon with which virtually everyone is familiar, whether dreading a medical appointment, a job interview, or the impending death of a loved one. Despite the prevalence of dread in most people's everyday lives, surprisingly little empirical research has explored the construct. The purpose of the current research was to examine psychological dread (Study 1 and Study 2) and to compare dread to extreme persistent fear (Study 2). Respondents across both studies completed surveys on which they described a dreaded experience (Studies 1 and 2) or an extremely feared event (Study 2) and answered questions about the event. Participants reported uncertainty and lack of control surrounding events associated with both dread and extreme persistent fear. They also anticipated that they would feel relief when these events were over, but this relief was greater with dread than fear. Implications for coping with dread and extreme persistent fears are discussed along with comparisons of the types of events most commonly associated with dread and extreme fear.

From Resource Scarcity to Psychological Toll: Challenges Faced by Mental Health Crisis Workers

Priya Gupta
University of Pittsburgh
School of Social Work
Research Faculty Mentor: Leah Jacobs, School of Social Work, University of Pittsburgh

In recent years, national interest in improving mental health crisis response services has increased. A large body of research, as well as high-profile media coverage, has demonstrated the harm that can occur when police officers respond to mental health crises, including arrest, use of force, or even death. In efforts to reduce reliance on police for addressing mental health crises, 2020 legislation established the nationwide 988 Suicide & Crisis Hotline to redirect calls to trained mental health professionals. Among such interventions are mobile crisis teams, which respond to mental health crises in community settings. The growing recognition that mobile crisis teams are a critical component to comprehensive crisis response systems has been unaccompanied by an increase in the mobile crisis workforce. Furthermore, we know of no prior research that attempts to understand disincentives to entry into this field.

This study represents a first step toward understanding the challenges faced by mobile crisis workers so that service systems can improve working conditions and increase the mobile crisis workforce. As a part of a nationwide survey of mobile crisis workers (n = 369), this student-led study used a qualitative analysis approach to analyze responses to open-ended questions about mobile crisis workers' perceptions of challenges faced in their work. Findings indicated that crisis workers face challenges that span from workplace conditions to social and economic structures that inhibit their wellbeing and work. Ultimately, growing the mental health crisis response workforce will require serious improvements in working conditions and investments in community mental health service systems.

Development and validation of an interpretation bias measure for death anxiety

Frances Grace Hart
Boston College
Department of Psychology, Boston College
Research Faculty Mentor: Courtney Beard, PhD and Karen Rosen, PhD, Depression and Anxiety; Department of Psychology, McLean Hospital; Boston College

Research Collaborators: Hudson, C. C., George, G. C., Menzies, R. E., Beard, C.

Death anxiety (DA) is a multidimensional construct implicated in up to 15 psychological disorders. Interpretation bias (IB), the inclination to interpret ambiguous situations negatively, may be a mechanism driving DA given the uncertainty commonly associated with death. To

investigate this potential link, we used the Word-Sentence Association Paradigm (WSAP), which assesses how individuals interpret ambiguous situations, to determine the relationship between DA and IB. Thus, the current study developed a DA-WSAP.

We developed an initial pool of DA stimuli after a thorough review of DA and IB research. We created ambiguous situations relevant to death-related fears for self and others. We then created words representing a negative, positive, and neutral interpretation of each situation, and for three DA components (beliefs, affect, behavior). This reflects the structure of the Death Anxiety Beliefs and Behaviors Scale (DABBS). Participants (N = 85) completed a demographic form, the DABBS, the 7-Item Generalized Anxiety Disorder, and DA-WSAP task online.

In line with hypotheses, DA and IB were positively correlated ($r = 0.35$, $p = .002$) and IB and intolerance of uncertainty interacted to produce DA ($p = .009$). Exploratory analyses examining the ambiguity of death yielded mixed results, with death only being considered ambiguous when participants were prompted to reflect on how they felt about their own deaths. Psychometric analyses will be ready by the conference.

Future studies should determine if IB is driving DA. If so, digital interventions leveraging the WSAP may be effective in reducing DA.

Nuclear & Biomedical Engr.	9:15 - 10: 15 am	McKenna Hall, Room B02

Design and Simulation of a Nuclear Thermal Propulsion Rocket Engine

Camden Eck
Georgia Institute of Technology
Daniel Guggenheim School of Aerospace Engineering
Research Faculty Mentor: Dr. Dan Kotlyar, George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology

Research Collaborators: William Yates, Georgia Institute of Technology, George W. Woodruff School of Mechanical Engineering
Rory Myers, Georgia Institute of Technology, George W. Woodruff School of Mechanical Engineering

In planning a manned exploration to Mars, one of the most prominent obstacles is the distance, the over 360 million miles that would need to be traversed. Nuclear Thermal Propulsion (NTP), with its combination of high efficiency and thrust, is an appealing option for cutting down on travel time. In an NTP engine, a fission reactor is used to efficiently heat hydrogen before expelling it through a nozzle. Given NASA and DARPA's current collaboration to build a working NTP prototype rocket as well as plans to scale this technology for a Mars mission and beyond,

the need for a functional engine design is apparent. A working engine design must address a range of constraints and performance metrics. It must heat hydrogen propellant to incredibly high temperatures without overheating the reactor or inducing too much vibration in the reactor's fuel channels. The reactor must be stable, achieving criticality for the duration of all maneuvers, but it also must be light enough to be feasibly launched into space. This presentation outlines the simulation methods used to iterate and drive the design that meets all these demands. This design was generated using tools developed in-house for system-level and thermal hydraulic analysis. It was then simulated using the Monte Carlo based Serpent code to analyze its neutronic behavior. In satisfying these constraints, it also underlines the efficiency and power that makes NTP so desirable, reaching a specific impulse roughly double that of modern chemical-propulsion rockets and thrust of over 30 thousand pounds.

An Atomistic Study of the Radiation Resistance of Grain Boundaries in High Entropy Alloys

Sarah Paguaga
Clemson University
Mechanical Engineering
Research Faculty Mentor: Enrique Martinez, Mechanical Engineering, Clemson University and and Saryu Fensin, Los Alamos National Laboratory

Research Collaborators: Ian Chesser , Los Alamos National Laboratory
Saryu Fensin , Los Alamos National Laboratory
Enrique Martinez , Clemson University

As advancements are made in nuclear systems, fusion reactors, space exploration, etc., there is a prevalent need for a radiation resistant material that can withstand mechanical extremes. High Entropy Alloys (HEA) are a strong contender for this role as they contain great material properties and are highly damage tolerant. The mechanisms of radiation damage tolerance at GBs in HEAs are not well surveyed or understood. To address this knowledge gap, we simulate high dose radiation damage in an HEA system of FeNiCrCoAl composition with a Creation Relaxation Algorithm (CRA). Then the GB sink efficiency, how well it can absorb the inserted defects, is analyzed by observing the average total energy and the GB development to discover if the structure reaches an asymptotic structure. The composition was analyzed as well to see if radiation damage has an influence and causes radiation induced segregation. It was found the sink efficiency leads to local structural changes at the GB that can be well quantified as steady state disordered GB structures with induced elemental segregation. This analysis can provide insight into how GB can influence HEA composition and microstructure evolution with radiation damage.

Effect of Brachial Plexus Birth Injury on Bone Growth

Katie B. Taran

North Carolina State University
Biomedical Engineering
Research Faculty Mentor: Jacqueline Cole, Biomedical Engineering, North Carolina State University

Research Collaborators: Kyla B. Bosh, North Carolina State University, Biomedical Engineering
Katherine R. Saul, North Carolina State University, Mechanical Engineering
Jacqueline H. Cole, North Carolina State University, Biomedical Engineering
Kerry A. Danelson, Wake Forest University, Orthopaedic Surgery
Roger Cornwall, University of Cincinnati, Orthopaedic Surgery

Brachial plexus birth injury (BPBI) occurs during difficult births when the neck is excessively stretched, causing musculoskeletal deformity in the glenohumeral joint, which impairs shoulder range of motion and functional arm movements. Sequelae differ depending on nerve injury location (postganglionic or preganglionic), but little is known about the changes in bone formation and mineralization over time, which could inform targeted treatments.

Sprague Dawley rats were divided into 4 surgical groups (postganglionic or preganglionic neurectomy, forelimb disarticulation, or sham) and received surgery on one forelimb at postnatal days 3-6. Prior to sacrifice (2, 3, 4, 8, or 16 wks with n=9-60 per timepoint), calcein and alizarin fluorochrome labels were injected to measure bone formation. Humeri were dissected, sectioned into transverse (cortical bone) and longitudinal (trabecular bone) sections, imaged, and analyzed using standard dynamic histomorphometry. Metrics were compared across groups with ANOVA and Tukey posthoc tests (GraphPad Prism, $\alpha<0.05$).

Preliminary results for the postganglionic group: Trabecular bone volume fraction was greater at 8 weeks than 4 weeks. Total bone tissue cross-sectional area and cortical bone area were lower at 8 weeks than 4 weeks. Endosteal and periosteal mineral apposition rate and bone formation were greater at 4 weeks than 8 weeks for both limbs. These results suggest that BPBI reduces bone growth and mineralization over time during early postnatal development. Further analysis of additional timepoints and groups will reveal how bone growth and mineralization are altered following BPBI, which is critical for developing more targeted and timelier treatment strategies.

Gut & Reproductive Health	9:15 - 10:15 am	Morris Inn, Hesburgh Room

Embryonic Heat Exposure Leads to Later-Life Stress Resiliency: Molecular and Morphological Mechanisms in the Gut

David Beck
Virginia Polytechnic Institute and State University
Neuroscience
Research Faculty Mentor: Elizabeth Gilbert, Animal and Poultry Sciences, Virginia Tech, Mark Cline, School of Neuroscience, Virginia Tech

Early-life stress increases the likelihood of subsequent health disorders. One potential mechanism involves disruptions in gut function. Chickens, being self-sufficient after hatching and devoid of parental influence, provide an excellent model to study these processes. We discovered that slightly increasing ambient temperature during particular stages of incubation increases chicks' later stress-resiliency. Mechanisms likely involve epigenetic (environmental and behavioral gene regulation) pathways. We examined effects of elevated incubation temperatures, coupled with a later-life heat stressor, to understand how embryonic heat conditioning (EHC) affects gut function and stress responses. Small intestine samples (duodenum, jejunum, ileum) were collected at various time-points during a post-hatch heat challenge. Gene expression (measured via real-time polymerase chain reaction) associated with free radicals, nutrient transport, and tissue integrity were analyzed, as were morphological characteristics including villus height and crypt depth. Oxidative stress markers were generally down-regulated in EHC chicks, with the most pronounced effects in the proximal small intestine. Temporally, gene expression changes in response to the heat challenge were similar between control and EHC chicks. Crypt depth, a structural marker of stem-cell proliferation, was greater in control than EHC chicks at 2 hours post-challenge, and villus-height-to-crypt-depth ratio (marker of absorptive surface area) increased from 2 to 12 hours in control but not EHC chicks. Collectively, results suggest EHC chicks might be more efficient at coping with heat stress, allowing preferential allocation of nutrients to other tissues while protecting intestinal tissue from oxidative damage. As global temperatures rise, addressing ways to mitigate physiological impacts becomes an urgent concern.

Development of a Three-Dimensional Endometrial Model to Examine Factors Affecting Endometrial Function

Sarah Broyhill
University of North Carolina at Chapel Hill
Biology
Research Faculty Mentor: Dr. Steven L Young, Division of Reproductive Endocrinology and Infertility, Duke School of Medicine

Research Collaborators: Dr. Steven L. Young, MD, PhD, Duke School of Medicine, Division of Reproductive Endocrinology and Infertility
Dr. Lingwen Yuan, PhD, Duke School of Medicine, Division of Reproductive Endocrinology and Infertility

Endometriosis, a reproductive disease affecting one in ten women, is characterized by debilitating pain, excessive menstrual bleeding, and infertility. Elevated levels of certain proteins, such as pro-inflammatory cytokines and SIRT1, are seen in endometrial tissue from endometriosis patients and are thought to be contributing factors to infertility by negatively affecting the endometrium's ability to decidualize prior to implantation. Given the inherent limitations of studying the human endometrium in vivo, there is a need to develop an in vitro model to study the endometrium and its interaction with trophoblast cells that will form the

placenta. These studies were aimed to develop one part of a three-dimensional model of the endometrium using a the semi-synthetic, derivatized collagen matrix, GelMA, and endometrial stromal cells. An essential function of endometrial cells is decidualization, a conversion from mesenchymal-like to epithelial-like cells and reflected by a large change in gene expression including a marked increase in prolactin (PRL) production. Optimization of the 3-D model involved RT-qPCR to measure PRL gene expression with or without combined treatment with decidualization factors (estradiol (10-8 M), medroxyprogesterone (10-6 M), and cAMP (10-6 M)). We also compared that response to stromal cells on plastic in 2-D culture. Decidualization was successfully induced in the 3-D culture conditions, in a manner similar to that seen on plastic (and in vivo). The development of this model opens the door for future investigations aimed at better understanding the molecular functions of the endometrium and the etiologies underlying idiopathic infertility, as well as helping discover protein targets for novel drug therapies that combat infertility in women with endometriosis.

Host-Microbe Interactions: Interactions and Manipulations of Bacteroides in the Gut Microbiome

Alexys R. King
Clemson University
Microbiology
Research Faculty Mentor: Dr. Kristi Whitehead, Microbiology, Clemson University

Research Collaborators: Dr. Kristi Whitehead, Clemson University, Department of Microbiology; Emma F. Tackett, Clemson University, Senior in Microbiology; Jordyn P. Nahum, Clemson University, Junior in Microbiology

Bacteria in the Bacteroides genus are commonly found in the gut microbiome as commensal organisms. Certain species of the Bacteroides genus can cause severe disease, such as intra-abdominal sepsis, bacteremia, skin and soft tissue infections, meningitis, intra-abdominal abscesses, and other inflammatory infections. These non-symbiotic species can also exacerbate pre-existing conditions such as ulcerative colitis, inflammatory bowel disease, celiac disease, and colorectal cancer. The autoimmunity aspects of Type 1 Diabetes may also be triggered. The Bacteroides genus utilizes a starch utilization system (SUS) that allows the bacteria to metabolize carbohydrate-based compounds. Recently, we discovered that the SUS system could be inhibited by introducing acarbose, stopping the progression of complex carbohydrate metabolism, specifically potato starch and pullulan.

We are currently manipulating the Bacteroides environment to understand better how the downstream effects of inhibiting the SUS affect the virulence factors of the enterotoxigenic Bacteroides fragilis, including antibiotic resistance. B. fragilis exhibits resistance to many of the most used antibiotics. We hypothesize that disrupting the SUS pathway via acarbose will allow for the potentiation of antibiotics against B. fragilis. The antibiotics we are currently examining are Beta-Lactams, also known as penicillin and penicillin derivatives. By disrupting one of the

significant carbohydrate metabolic pathways in Bacteroides, we hope to decrease its overall fitness, creating an increased susceptibility to antibiotics.

Poster Session 1

Poster Session 1	10:30 - 11:45 am	Morris Inn, Salon Smith Ballroom B

Revealing Inconsistencies Between Epworth Scores and Apnea-Hypopnea Index when Evaluating Obstructive Sleep Apnea Severity

Dylan Amiri
University of Miami
Department of Biology
Research Faculty Mentor: Oliver Bracko, Department of Biology, University of Miami

Research Collaborators: Robert Nahouraii, Mecklenburg Neurology Group & Mecklenburg Epilepsy and Sleep Center, Department of Neurology

A common practice in clinical settings is the use of the Epworth Sleepiness Scale (ESS) and Apnea-Hypopnea Index (AHI) together to predict the severity of obstructive sleep apnea (OSA). However, several instances were noted where there were discrepancies in the reported severity between Epworth scores and AHI in our patient sample, prompting an investigation into whether AHI is a more accurate predictor of OSA severity than ESS. Discrepancies were examined by categorizing patients into two categories of inconsistency: individuals with either (1) ESS < 10 and AHI ≥ 15 events/hr or (2) ESS ≥ 10 and AHI < 15 events/hr. Sex differences were explored by assessing mean ESS and AHI for men and women. Additionally, the study examined BMI as an independent variable and with respect to sex, along with considering anxiety. In category (1) the average ESS of 5.27 ± 0.33 suggests a normal level of daytime sleepiness. However, this contrasts with the average AHI of 32.26 ± 1.82 events/hr which is indicative of severe OSA. In category (2) the average ESS of 14.29 ± 0.47 suggests severe daytime sleepiness, contradicting the average AHI of 9.16 ± 0.44 events/hr which only indicates mild OSA. BMI–both independently and with respect to sex–and anxiety contributed to observed inconsistencies. The findings of our study substantiate our hypothesis that Epworth scores should be de-emphasized in the assessment of OSA and a greater importance should be placed on measures like AHI.

Mitochondrial Responses to mtDNA Damage: Mitophagy and Extracellular mtDNA Release

Sasha Bacot

Duke University
Duke Nicholas School of the Environment
Research Faculty Mentor: Joel Meyer, Duke Nicholas School of the Environment, Duke University

Research Collaborators: Sasha Bacot, Ian Ryde, Javier Huayta, Joel Meyer

Mitochondrial DNA (mtDNA) is particularly susceptible to ultraviolet C (UVC)-induced damage due to a lack of nucleotide excision repair (NER) and the low fidelity of mitochondrial polymerase γ. Irreparable damage caused by UVC irradiation may lead to double stranded breaks or point mutations in mtDNA, causing mitochondrial dysfunction and contributing to aging/aging-related disease. Surprisingly, previous work has not shown a significant increase in mtDNA mutation frequency following UVC irradiation, suggesting that the mitochondria possess an uncharacterized mechanism(s) to selectively resolve damaged mtDNAs. Using C. elegans models, we assessed mitophagy and extracellular mtDNA release as mechanisms by which the cell removes damaged mtDNAs with mutagenic potential. We used fluorescent reporter strains to measure the regulation of the PINK-1 and FNDC-1 mitophagy pathways up to 24 hours after UVC exposure, and mtDNA copy number assays to measure mtDNA release into the supernatant surrounding suspended C. elegans samples. Our results indicated a developmentally-linked increase in PINK-1 and FNDC-1 expression overtime and a rapid induction of the PINK-1 pathway in response to UVC irradiation. Furthermore, we found evidence of increased mtDNA copy number in the supernatant surrounding UVC irradiated nematode samples. Our findings suggest that rapid PINK-1 induction and mtDNA release are mechanisms utilized by the mitochondria to compensate for stress and irreparable mtDNA damage. Our future work aims to determine how mtDNA damage/mutation is detected within the mitochondria to elicit these mechanisms of mitochondrial quality control.

Investigating the Right Open Reading Frame Kinase - Nuclear Factor Kappa-light-chain-enhancer Interaction in Prostate Cancer

Abby Cortez
Duke University
Department of Pathology
Research Faculty Mentor: Everardo Macias, Pathology, Duke University

Right Open Reading Frame Kinase (RIOK2) is critical in ribosome assembly, which is needed for proliferating cancer cells. Targeting RIOK2 is shown to decrease tumor growth, likely due to impairment of ribosome biogenesis. Recently, our group discovered that RIOK2 has novel DNA binding activity, but there are still unknowns such as the cofactors it binds. A published high-throughput mass spectroscopy study suggests that RIOK2 interacts with RELA, a subunit of Nuclear Factor Kappa-light-chain-enhancer (NF-kB). NF-kB is a transcription factor that regulates genes essential for cancer cells. We hypothesize the RIOK2-NF-kB interaction

supports disease progression. A nuclear-fractionation experiment showed RIOK2 in the nucleus and cytoplasm. A co-immunoprecipitation assay of 22RV1 and PC3 cell lysates showed that NF-kB was bound to RIOK2 when not part of a ribosome complex. A drug combination assay indicated an additive effect on proliferation when co-targeting both proteins. The results of preliminary studies validated the presence of an NF-kB -RIOK2 interaction in prostate cancer cells. Next, we will conduct a nuclear-fractionation assay targeting RIOK2 or NF-kB to understand where the interaction occurs and its regulation. Conversely, we will use NF-kB activating ligands to determine how activation of NF-kB affects RIOK2-NF-kB binding. An understanding of this interaction is important to understand basic cancer cell biology and for potential translational interventions.

Wild Hogs on the Clemson Experimental Forest: Radio/GPS tracking invasive wild hogs in Clemson

Tucker Cribb
Clemson University
Wildlife and Fisheries Biology
Research Faculty Mentor: Erin Buchholtz, Forestry and Environmental Conservation , Clemson University

Research Collaborators: Erin Buchholtz, Clemson University, Forestry and Environmental Conservation, Andrew Jamison, Clemson University, Forestry and Environmental Conservation Greg Yarrow, Clemson University, College of Agriculture, Forestry, and Life Sciences

South Carolina has seen a recent and dramatic increase in the distribution and abundance of wild hogs. The proliferation of wild hogs has increased the damage these animals cause to natural, agricultural, and developed landscapes. Over the last decade, wild hogs have been introduced to and established themselves on both the south (Fant's Grove Wildlife Management Area) and north (Lake Issaqueena) portions of the Clemson Experimental Forest (CUEF), bringing with them, significant damage to both the CUEF and the adjoining private properties. Unfortunately, the ecology, habitat use, and movements of wild hogs on the CUEF are unknown. This project examines the movements, home ranges, and habitat selection habits of wild hogs on the CUEF. During the 2023 spring and fall semesters, 19 hogs (11 males and 8 females) were captured and fitted with both GPS and radio collars. We analyzed movement data to determine the overall habitat selection habits of the hogs. We categorized habitat types using the National Land Cover Database. We created home range and available habitat models using Kernal Density Estimation (KDE). The information gathered from this study will help the effort of controlling this invasive species in the CUEF.

Protecting Endangered Species in the US: A Historical Analysis of Reactive Environmental Law and Public Resistance

Anna Davis
Boston College
History
Research Faculty Mentor: Prasannan Parthasarathi, History, Boston College

This work analyzes the various modes of thinking that developed in response to the enactment of the Endangered Species Act in 1973. What was initially a widely supported law among the government and the public soon became one of the most controversial environmental laws in the United States. Utilizing congressional hearings, government records, laws, legal cases, newspaper articles, periodicals, photographs, and public surveys, this study rejects the common conception that economic self-interest is the sole driver of opposition to the Act, and rather suggests that it is the reactive, as opposed to proactive, framework of the law which fuels the potential for conflict. People ultimately want to protect and preserve endangered species, but respond negatively to the law's lack of precautionary, long-term thinking. It is clear that this approach to environmental legislation is a common trend in the United States, continuing to spark controversy and polarize environmental movements across the nation.

Exploring the Effects of Plasma Radiation on the pH of Solutions for Potential Medical Applications

Beatriz de Campos Silva
University of Notre Dame
Department of Physics and Astronomy; Notre Dame Radiation Laboratory
Research Faculty Mentor: Dr. Sylwia Ptasinska, Department of Physics and Astronomy; Notre Dame Radiation Laboratory, University of Notre Dame

Despite cancer being the second leading cause of mortality worldwide, current treatments still have limitations, such as drug resistance, cytotoxicity to healthy tissues, and high recurrence rates. Plasma medicine, specifically low-temperature plasma (LTP), has provided effective cancer therapies in recent years, with potent effects on cancer cells and minimal side effects on healthy tissues. This study investigates how LTP irradiation affects pH in solutions, which is relevant to understanding cancer cell behavior, growth, and spread. Further experiments with glycine are conducted to assess how the process is altered in the presence of a biomolecule, given its relevance to cancer pathways and cell metabolism. Our findings indicate that a combination of high voltage, high frequency, and long irradiation times leads to greater acidification of pure water solutions. Additionally, when each irradiation time is analyzed separately, an increase in voltage seems to play a more significant role in lowering the pH of water solutions. Experiments with glycine showed that higher amino acid concentrations enhance pH stability, while lower concentrations cause similar pH variations as observed in pure solutions. These results offer insights into body pH stability during LTP treatments, which can inform effective cancer therapies targeting cancer cells without affecting healthy tissues.

Allele-Specific Splicing Analysis in Mus musculus and Mus spretus through utilization of F1 Dihybrid Crosses

Jack Engel
University of Virginia
Biochemistry, University of Virginia
Research Faculty Mentor: Hui Li, Pathology, University of Virginia

Research Collaborators: Samuel Haddox, Department of Biochemistry and Molecular Genetics, University of Virginia

The spliceosomal processing of precursor messenger RNA (pre-mRNA) facilitates genomic functional expansion by generating various protein-coding or noncoding isoforms from a single gene. Canonically, splicing involves the formation of a lariat loop, bringing non-adjacent exonic sequences within an mRNA molecule together in a cis manner. Recent evidence challenges the belief that trans-splicing, joining exonic sequences from separate mRNA molecules, is strictly limited in higher eukaryotes. Despite being historically rare, chimeric transcripts formed between distal, non-adjacent genes have highlighted the potential for trans-splicing in mammals. By leveraging genomic variance between two distinct breedable mouse species, allelic origins of mRNA molecules in F1 dihybrid crosses can reveal trans-spliced chimeric reads originating from both alleles of the same gene.

We employed RNA-sequencing (RNA-seq) data from Mus musculus and Mus spretus mouse breeds to investigate cis- and trans-splicing events in F1 dihybrid crosses. A bioinformatic pipeline utilizing single nucleotide polymorphisms (SNPs) distinguished between M. musculus and M. spretus genomes within RNA-seq reads. F1 dihybrid samples from skeletal muscle, heart, lung, and kidney underwent thorough filtering to identify splicing event candidates. Parental RNA-seq data aided in removing inaccurate SNP associations, and a 1:1 mix of each parent controlled experimental reverse transcriptase template switching artifacts. Initially, samples contained roughly 50 million reads, 2.5 million SNPs, and 12,000 unique genes – filtered to less than 10,000 reads, up to 54,000 SNPs, and approximately 2,500 genes. Certain genes exhibited high confidence and elevated presence in specific tissue types, notably Rpl isoforms in skeletal muscle and Rps isoforms in heart.

Completing the Puzzle: Genome Sequencing of Tomato Lanai

Reshma Goud
North Carolina State University
Department of Molecular and Structural Biochemistry
Research Faculty Mentor: Dr. Trino Ascencio-Ibáñez, Department of Molecular and Structural Biochemistry, North Carolina State University

The primary aim of this research project is to fully sequence the genome of tomato Lanai. Our laboratory has proposed tomato Lanai as a useful laboratory tomato variety for viral studies, due to its determinate height, rapid development, and viral symptom display. The complete sequencing of the Lanai tomato genome is vital for a thorough comprehension of its genetic composition. This is fundamental for exploring its biological functions and potential applications, particularly in the context of gene expression studies. Recognizing the high cost and lack of educational value in outsourcing samples for sequencing, our laboratory sought to establish an in-house sequencing capability to meet our educational and research needs. To tackle this challenge, we employed Oxford Nanopore sequencing technology. This method was chosen for its ability to sequence long strands of DNA, which is vital for assembling a complete genome. The project began with careful total DNA sample preparation, ensuring the integrity of the genetic material. After successfully running the samples in the sequencer and acquiring base pairs, our next task is to map the genetic sequences to the reference genome to reconstruct the tomato Lanai genome. This information will help us in our future research on changes in gene expression patterns and other biological functions. Additionally, the development and refinement of Nanopore sequencing techniques within our lab will not only advance our research but also enrich the experimental biochemistry curriculum, offering hands-on learning experiences for students in the Molecular and Structural Biochemistry Department at NC State University.

In-Tact | *Textiles and Tactile Architecture in a Post-Pandemic World*

Katherine Harland
Clemson University
Clemson University School of Architecture
Research Faculty Mentor: Dr. Andreea Mihalache, Co-Director of Architecture Graduate Programs, Clemson University

In-Tact is a philosophical and architectural endeavor to explore the impact of haptics on architecture, human authenticity, and emotional engagement. One of the most fundamental human senses and ways of perceiving the world is through touch. As Confucius is quoted saying, “What I hear, I forget. What I see, I remember. What I touch, I understand.” In our nature is the yearning to grasp. The yearning for participation. The yearning for authenticity. However, as the world continues to rapidly solidify a digital landscape and emerge from the complete cultural and psychologi¬cal shift of the Covid-19 pandemic, design has developed in absence of the poignancy of spatial and tactile presence. As a result, this research aims to address how textiles, tactility, and architectural space can emerge to provide engaging and authentic design.

The process for the project includes a curated collection of research in architectural writings, an experimental artistic installation based on parametric surfaces, and a real-world community pavilion proposal in Greenville, SC. All of these explore the questions: How can geometry and spatial parametric manipulations enhance authentic human touch? How do textiles specifically help address temporal and tactile design on the community architectural scale? These

questions lead to a dynamic collection of visual models that challenge both the process of making and inhabiting architectural spaces.

Electropolymerization as a Method to Create Irreversible Electrochromic Indicators

Divya B. Iyer
Georgia Institute of Technology
Materials Science and Engineering
Research Faculty Mentor: Anna Österholm, School of Chemistry and Biochemistry, Georgia Institute of Technology

Research Collaborators: Anna Österholm, Georgia Institute of Technology, School of Chemistry and Biochemistry,
Eric Shen, Georgia Institute of Technology, School of Chemistry and Biochemistry,
Carlos Pinheiro, Ynvisible Interactive,
John Reynolds, Georgia Institute of Technology, School of Chemistry and Biochemistry and Materials Science and Engineering

Irreversible Visual Indicators (IVIs) are devices that can display information on-demand and in response to an external signal, with applications in monitoring labels, product status, digital signage, security, and sensors. IVIs can be distinguished from standard electronics in that they display information permanently, while using zero energy and are impossible to erase. This work aims to build on previous studies on these devices and develop IVIs that can display information in a wide array of colors. IVIs employ the use of electrochromism, where a material or device changes color in response to application of a small voltage or current. The mechanism explored in this work to create such devices is electropolymerization, in which small conjugated organic molecules are stimulated by an electric current to form long conjugated chains. This conjugation allows the resulting polymers to absorb visible light and appear in a wide spectrum of colors, based on the original monomer. These devices are tested to determine the color, as well as probed for irreversibility. Testing conditions are standardized so that the polymerization occurs over five minutes, with a 3 V oxidizing potential, followed by a short -1.5 V reducing potential. By varying the structure of the molecule in the device, it is demonstrated that IVIs can switch from 100% transparent to red, orange, green, blue, purple, and black. This work details the steps of electrochromic device fabrication specifically for irreversible indicators, and strives to create straightforward processing methods for IVIs.

Description and analysis of Jarawan negation

Aaron J. Lener
Syracuse University
Department of Languages, Literatures, and Linguistics

Research Faculty Mentor: Christopher R. Green, Department of Languages, Literatures, and Linguistics, Syracuse University

This project is the first to document and describe patterns of negation in Jarawan languages. Research on these languages, spoken in northeastern Nigeria, has been hindered by political instability and inhospitable terrain for many years. However, with the help of smartphone technology, investigation into the structure of Jarawan languages has recently been made possible. The goal of the current project is to contribute to what linguists know about the syntax, morphology, and phonology of Jarawan languages by exploring the various morphemes and phrasal structures involved in negation in two varieties of Jarawan, Mbat and Galamkya. Jarawan languages are spoken in an area noted for diverse negation strategies, sometimes involving one or two negators. Languages differ in whether and which negator is optional, as well as in the forms and conditions of their negative words. A descriptive analysis of negation in Mbat and Galamkya, using translations and grammaticality judgments elicited from native speakers, promises to advance our typological understanding of negation in African languages. Additionally, due to the lack of comprehensive description, linguists have faced difficulties classifying the Jarawan languages both internally (relative to their closest relations) and externally (relative to their more distant relations). This project will shed important light on the issues of contemporary interest to historians, historical linguists, and typologists.

Development of Robotic Histotripsy Systems for the Precise, Complete, and Non-invasive Ablation of Osteosarcoma Tumors

Thomas Lu
Virginia Polytechnic Institute and State University
Electrical & Computer Engineering
Research Faculty Mentor: Dr. Eli Vlaisavljevich, Biomedical Engineering and Mechanics, Virginia Polytechnic Institute and State University

Research Collaborators: Lauren Ruger, Virginia Polytechnic Institute and State University, Biomedical Engineering and Mechanics; Eli Vlaisavljevich, Virginia Polytechnic Institute and State University, Biomedical Engineering and Mechanics

Osteosarcoma (OS), the most common primary bone tumor in humans and dogs, is a devastating disease. The current standard of care for appendicular OS involves limb amputation or salvage surgery with chemotherapy. These highly invasive procedures have failed to improve patient survival in the last 30 years.

Histotripsy is the first non-invasive, non-ionizing, non-thermal ablation method that uses short, high-intensity focused ultrasound pulses to achieve precise mechanical disruption of cells. Recent studies have demonstrated the feasibility and safety of using histotripsy to treat appendicular OS in dogs. However, significant challenges remain before clinical translation. First, the clinical, FDA-approved histotripsy treatment system can only execute ellipsoidal

volume treatments with uniform treatment dosing, but OS tumors are irregularly shaped and heterogeneous, containing both hard (mineralized) and soft tissues. Additionally, bony obstructions can severely limit targeting and treatment planning through ultrasound, which the clinical system relies upon.

To address these limitations, this study aims to develop novel histotripsy treatment and robotic targeting methods for fully ablating arbitrarily shaped, heterogeneous tumors. We have designed a new system that utilizes pre-treatment imaging (MRI, CT) to characterize tumor shape and composition, allowing for precise, patient-specific treatments with arbitrary volume/dosing schemes, even in the absence of clear ultrasound imaging. To implement and test this design, we have built a custom, robotically-guided histotripsy treatment platform for ex-vivo use. Ongoing studies are planned to experimentally validate the full ablation of OS tumors upon completion of the treatment approach, using a clinically-relevant ultrasound transducer to treat excised canine OS samples.

Using Microfluidics and Agent-Based Modeling to Evaluate the Role of Porous Media in Chemotactic Migration

Elizabeth M. Mills
University of Virginia
Chemical Engineering
Research Faculty Mentor: Roseanne Ford, Chemical Engineering, University of Virginia

Research Collaborators: Rhea Braun, University of Virginia, Chemical Engineering

Bacteria inhabit and move in many types of porous spaces, from Earth's groundwater to our lungs. When considering porous nature, we are faced with a large number of parameters that can describe them, which in turn influences bacterial swimming. Research has shown that changes in the parameters of porous spaces like porosity can affect how bacterial populations travel, finding that bacterial migration is limited by more tortuous, obstacle-laden paths. Most studies have focused on basic bacterial motility, which is modeled as a random walk behavior. However, bacterial motility is rarely uniform. Bacteria respond to the many chemical cues around them, biasing their motion through a process called chemotaxis. Despite our understanding of how porous spaces impact random motility, we do not have a good sense of how chemotaxis is impacted by limitations in porous environments. Quantifying the impact of porous spaces on bacterial chemotaxis separately from motility requires understanding how the same barriers that limit motility affect chemotactic responses. The goal of this project is to characterize the different porous environments that bacteria encounter, and simulate and experimentally determine the effects of porous media on chemotaxis. A carbopol-based medium was used to model porous media and characterized, finding that the average pore size of the media was 1.4μm. Without chemoeffector added, the average lengths that bacteria could move within porous spaces was found to be 3.2-3.9μm. Nanoparticles, bacteria, and agent-based

modeling show the expected pattern of confined diffusion within the porous media during characterization, experimentation, and simulation.

Disposable E-Cigarettes Evoke Arrhythmias Dependent on Flavors

Romith Paily
University of Louisville
Public Health
Research Faculty Mentor: Alex Carll, Physiology, University of Louisville School of Medicine

Research Collaborators: Anand Ramalingam, Postdoctoral Associate, School of Medicine, Center for Cardiometabolic Science, University of Louisville

E-cigarette (e-cig) use has proliferated among youth due to the variety of flavors available in disposable pod devices. Yet, the health effects of disposable e-cigs and their various flavors remain largely unknown. Therefore, I tested the acute cardiac toxicity of Puff disposable e-cig aerosols across various flavors. Adult C57BL/6J mice (n=8) were exposed to aerosols from nicotine-containing disposable Puff Max e-cigs (Clear, Banana-Ice, Cool Mint, Pineapple-Mango-Orange; 5% synthetic nicotine) and JUUL Menthol pods (5% nicotine; positive control). Electrocardiograms (ECGs) were acquired continuously using radiotelemetry and analyzed for treatment differences in heart rate (HR), HR Variability (HRV), ECG morphologic conduction measures, and frequency of Ventricular Premature Beats (VPBs), using mixed models with significance from control air exposure reported at $p<0.05$. Fruit-flavored disposable e-cigs (Banana-Ice and Pineapple-Mango-Orange) evoked significantly more VPBs vs. air (mean±SEM, 1.5±0.4 and 2.4±0.9 vs. 0.2±0.1 VPBs/hr, respectively). Pineapple-Mango-Orange disproportionately increased VPB incidence rate when compared to other aerosols, while it uniquely increased HRV, as indicated by standard deviation of normal R-R intervals (SDNN). Conversely, Banana-Ice and Clear increased HR and decreased SDNN during both puffing and recovery phases, while Pineapple-Mango-Orange, Cool Mint, and JUUL Menthol showed blunted increases in HR. The slighter tachycardia associated with Pineapple-Mango-Orange suggests flavor may exacerbate the arrhythmogenicity of e-cigs through mechanisms distinct from nicotine, the primary culprit of e-cig induced increases in HR. Interestingly, ECG morphology analysis did not reveal any gross relationship between flavors and repolarization indices. Disposable e-cigarette toxicity varies with flavors; research is needed to understand individual flavorants' health impacts.

Capturing the Black Struggle for Visibility Through the Vietnam War

Alivia Pierce

University of Pittsburgh
Africana Studies and Art History
Research Faculty Mentor: Gretchen Bender, History of Art and Architecture , University of Pittsburgh

Draft to print, place to place, and vision to action. A book is not merely a collection of pages but a vessel of remembrance, a vessel of learning, and a vessel of empathy. When paired with the powerful tools of art and activism, a book can truly change the trajectory of one's life.

This past summer under the Brackenridge Fellowship, I created a zine titled "CAN I KICK IT? : Discussing The Vietnam War." It serves as the beginning of a series that delves into broader explorations of particular struggles for Black visibility. My work is fueled by a desire to uncover the narratives that often fade with the passage of time. This zine is meant to give autonomy to the many Black Vietnam veterans who were silenced about their experiences upon coming home, my Papa being one of them.

This edition of "CAN I KICK IT?" was created through what some consider unconventional approaches of research. A stockpile of artist books, academic journals, poetry, catalogs, interviews, and even social media posts are to thank for much of my zine's contents. My Papa offered me precious memories as well. All aided in providing an intimate look at the lasting marks left upon the world around us. These pages challenge preconceived historical interpretations and share the untold truths of the Black community, having been changed irrevocably by the Vietnam War. They also encourage us to seek truth, empathy, and a deeper connection to the shared tapestry of our past.

Assessing the Bioactivity of Salvia Phytochemicals Against Breast Cancers

Allison Portaro
University of Louisville

Breast cancer is one of the most common cancers diagnosed in adults, with 2.3 million new cases worldwide in 2020. Plants have been used in traditional medicine and are a potential source of pharmaceuticals. One example is the large Lamiaceae (mint) family. The Salvia genus, commonly known as the sages, is the largest genus in Lamiaceae with almost 900 known species. Different species of salvia are found in parts of the US, and some have a history in traditional medicine to treat cancers and other ailments. Preliminary research on three salvia species (S. lyrata, S. lyrata var. Purple Knockout, and Salvia officinalis) revealed potent anticancer activity in the leaves of S. officinalis (common sage) and moderate activity in S. lyrata. The triple-negative breast cancer cell line, MDA-MB-231, was impacted most between three breast cancer cell lines assayed. To expand upon these findings, compounds were identified with high-performance liquid-chromatography (HPLC) and gas-chromatography paired with mass spectrometry (GC-MS). Research suggests that Salvia contains many different phenolic compounds, some of which have anticancer activity. Acid hydrolysis was also

employed to remove glycosides and thus influence extract polarity. Once active biomolecules were identified, the antiproliferation activity of specific isolated biomolecules and the potential for acid hydrolysis to increase antiproliferation activity were assayed.

Elucidating the Molecular Interactions that Mediate Lipid Nanoparticle Delivery of mRNA Into Immune Cells

---

Adriana Retamales Romero
University of North Carolina at Chapel Hill
UNC Eshelman School of Pharmacy
Research Faculty Mentor: Owen S. Fenton, Division of Pharmacoengineering and Molecular Pharmaceutics, UNC Eshelman School of Pharmacy

Research Collaborators: Bevin Neill, Yutian Ma, Owen S. Fenton*

The recent success of mRNA vaccines against COVID-19 has demonstrated their potential for the development of safe and effective therapeutics. However, the therapeutic potential of mRNA has been limited by the challenges of delivering it to target cells. One strategy to improve the safe and effective delivery of mRNAs into the body involves the development of nanocarriers such as lipid nanoparticles. Lipid nanoparticles act as non-viral vectors that protect the therapeutic mRNA from degrading and aid during intracellular delivery and endosomal escape. Here, we describe the design, formulation, and evaluation of lipid nanoparticles for the delivery of mRNA drugs. Specifically, this work investigates the molecular driving factors associated with LNP stability and how these different factors correlate with uptake in immune cells.

Single Cell Analysis of Circuit Deficits in Fragile X Syndrome

Melisa Sencer
Florida State University
Cellular and molecular neuroscience
Research Faculty Mentor: Yuan Wang, Biomedical Sciences, FSU College of Medicine

Fragile X syndrome (FXS) manifests profound sensory issues that exacerbate cognitive and social problems in patients. These issues are prominent in the auditory system, including hypersensitivity which challenges everyday noisy environments. The superior olive complex (SOC) comprises multiple brainstem nuclei and is a major auditory processor for localizing noise. It is poorly understood how neurons in SOC are defected in FXS. This study investigates the intrinsic connectivity of SOC in normal and a mouse model of FXS. Since conventional tracing methods do not have the resolution to dissect the intrinsic connectivity within SOC, I have established a procedure for intracellular dye-filling in the Wang Lab at Florida State University's College of Medicine. This has allowed me to analyze the morphology and connectivity of individual neurons in a brainstem nucleus within the SOC called the medial

nucleus of the trapezoid body (MNTB). My preliminary data has revealed a previously unknown projection to MNTB, suggesting a potential new layer of auditory processing. Through this investigation, valuable insights into the organization of the MNTB region and its axonal targets can be obtained. After intracellular filling, I use antibody staining and fluorescent imaging to reproduce highly detailed 3-D reconstructed images of MNTB neurons. Comparative analysis between wildtype and FXS mice neurons can then be analyzed to determine potential mechanisms contributing to auditory dysfunction in FXS. By combining innovative research and technological enhancement, I aim to deepen our understanding of auditory processing and contribute to broader neuroscience advancements such as widespread applications of single-cell techniques.

What Does College Have to Do With it? Emerging Adults' Responses to the Crises of 2020

Monica Soni
Wake Forest University
Psychology / Pre-Med
Research Faculty Mentor: Dr. Christy Buchanan, Psychology, Wake Forest University

Research Collaborators: Maddie Alexanian
Taylor Colony
Jasmine Marshall
Jill McMillan
Marianne Magjuka

The year 2020 presented the United Statues and its college campuses with dual challenges: an unprecedented pandemic that caused major disruption to life as we knew it, and publicized instances of police brutality that prompted a national conversation on racial discrimination and injustice. This study was conducted to provide insight into how college experiences influenced emerging adults' responses to these crises. Here we address college students' perceptions of the role various university "actors" had in their reactions and ability to cope during this time.

Data were drawn from eight focus groups involving 32 representatives from diverse campus groups and organizations (athletes, civic engagement groups, fraternities/sororities, intercultural groups, student leadership, and students who had taken a first year experience course) at a medium-sized liberal arts university. Participants responded to a variety of questions such as "How would you evaluate the response of (your school) to COVID-19 and/or racial unrest?" Responses were coded using a grounded theory approach. After multiple readings of transcripts and agreement on major themes, two study team members coded each segment of the focus group script until they reached 80% reliability; differences were resolved through discussion.

The data reported here contrasts perceptions of negative and positive actions on the part of several actors in the college context. The most frequent negative comments emerged for Administration and Students/Campus Culture. The most frequent positive comments emerged

for Academics (Faculty or Classmates) and non-Greek organizations. These and additional themes will be discussed.

Oral Session 2

Historical Perspectives on Conflict	1:15 - 2:15 pm	McKenna Hall, Room 202

Iraq as a Continuation of Vietnam: The Aging New Left and the War on Terror

Brendan Mahoney
Boston College
Boston College History Department
Research Faculty Mentor: Eddie Bonilla, Boston College History Department, Boston College

This project has the goal of filling in a gap of scholarship that exists in the study of New Left figures, and the last remaining ideas and tactics of New Left ideologies that still remained (in the early 2000s) despite the movement falling off in the 1970s. This gap is the activism that aging New Left figures participated in, either actively or passively, to protest the United States' War on Terror. This presentation will go over all of the research that I have already done regarding the topic at hand and my plans to implement this primary and secondary research into my thesis, which I have begun writing, and will finish in the next year. The thesis will focus on New Left figures such as Howard Zinn, Tom Hayden, Angela Davis, and their reflections and understandings of the War on Terror given the context of their organizing against the Vietnam War in the late 1960s and early 1970s. This thesis is comparative, but not reductive, and will recognize historiographically that not all crises are the same, although reactions from aging figures in the New Left represent a relative continuity and maintenance in ideology. Through the use of memoirs and articles written by each of these people in their peak years of organizing (the 1960s), as well as work written in their last years, the thesis will help digest their dogmatic congruences as well as adaptations to fit the twenty-first century problem of endless war in the Middle East.

Absolution for Empire: Military Chaplains in the First Gulf War (1990-1991)

Dane Sherman
University of Notre Dame
American Studies, Peace Studies, and Philosophy
Research Faculty Mentor: Dr Peter Cajka, American Studies, Notre Dame

Deaths of despair, homelessness, and mental health problems are rife within the ranks of United States Veterans. The Modern American soldier — conceived in an all volunteer military, advanced technologies, and endless unjust wars — is struggling. The First Gulf War from 1990-1991 lasted a total of only 42 days, rarely discussed and often forgotten. However, it provides an important aperture as the first United States military conflict since the end of the Cold War, with an ascendancy in modern military technology and a new United States hegemony. George HW Bush famously declared it as 'Bucking the Vietnam Syndrome' restoring America's confidence in the military might setting the stage for the 21st Century forever wars. Military Chaplains have been essential to United States armed services since the revolutionary war. Increasingly they find themselves trapped between their pastoral duties for the state, with soldiers in their care, and their prophetic duties to their faith, speaking against unjust warfare. Chaplains thus are a crucial and not discussed hinge piece for understanding the separation of church and state in warfare and the potential complicity of faith in the expansion of the American Empire. The end result is not pretty – 9/11 and the Wars in Iraq and Afghanistan – however, understanding the religious involvements in the first gulf war helps us understand those events better and offers some hope in understanding what needs to be done better going forward. The methodology of this study is archival research (George HW Bush Presidential Library in College Station, Catholic Worker Archives at Marquette, and Chaplain records at Catholic University), Interviews with Chaplains, Memoirs, and textual analysis of religious newspapers.

Biology in Medicine	1:15 - 2:15 pm	McKenna Hall, Room B01

Evaluation of crosstalk between the extrinsic and intrinsic pathways of coagulation

Sophia Dhrolia
University of North Carolina at Chapel Hill
University of North Carolina School of Medicine - Department of Hematology and Oncology
Research Faculty Mentor: Dr. Steven Grover, University of North Carolina School of Medicine - Department of Hematology and Oncology, University of North Carolina at Chapel Hill

FXI is a plasma zymogen in the intrinsic pathway of blood coagulation that contributes to the generation of thrombin. Individuals with FXI deficiency, also known as Hemophilia C, have a mild increase in bleeding. FXI is thought to be activated either by FXIIa in the intrinsic pathway or by thrombin generated through the extrinsic pathway (tissue factor (TF)-FVIIa) via a feedback loop. This ability of FXI to amplify thrombin generation would potentially explain the phenotype observed in FXI deficient individuals as the absence of FXI would lead to decreased thrombin generation and a less stable hemostatic plug. We decided to investigate the degree of activation of FXI via the extrinsic pathway. We developed an enzyme-linked immunosorbent assay (ELISA) to detect activated FXIa in complex with its endogenous negative regulator C1 inhibitor (C1INH) in human plasma. FXIa-C1INH complexes were measured in human plasma activated with different concentrations of TF. Complex formation in plasma was also evaluated with FXII

and fibrin inhibitors. Increased FXIa-C1INH complex formation was observed in the presence of TF. However, when FXIIa activity was blocked no measurable increase in FXIa levels were detected in plasma in the presence of TF. This work raises questions about if thrombin-mediated activation of FXI takes place in human plasma.

Weighted Vest Use to Mitigate Weight Loss-Associated Bone Loss in Older Adults: Process Measures from the INVEST in Bone Health Randomized Clinical Trial

Madison Howard
Wake Forest University
Health and Exercise Science
Research Faculty Mentor: Dr. Kristen Beavers , Health and Exercise Science , Wake Forest University

Research Collaborators: Monica Love, Wake Forest University, Health and Exercise Science

Background: Intentional weight loss (WL) in older adults is associated with bone loss, increasing risk of fracture. As skeletal tissue is responsive to mechanical stress, replacing lost weight externally may be an innovative way to minimize WL-associated bone loss in this population.
Methods: The main goal of the Incorporating Nutrition, Vests, Education, and Strength Training (INVEST) in Bone health trial (NCT04076618) is to examine the effect of 12-months of weighted vest use during intentional WL on several indicators of bone health, as compared to WL alone and WL plus traditional strength training exercise. Herein we report intervention process measures, including weight change (%), weighted vest wear time (hours/day), lost weight added to the weighted vest (%), and strength training adherence (% sessions attended; days/week) among finished participants.
Results: As of 2/17/2024, 143 (of 150) participants completed the trial. Average age was 66±5 years, the majority were white (69%) women (75%) with a body mass index of 34±3 kg/m². 12-month WL by group was 11.7±5.9%, 12.2±5.8%, and 9.7±4.6% for WL, WL+weighted vest, and WL+strength training, respectively. 12-month weighted vest wear time was 5.6±3.0 hours/day, with 85% of lost weight replaced in the vest. Participants assigned to WL+strength training attended 70% of classes, averaging 2.1 sessions attended/week over 12-months.
Discussion: Intervention process measure data for the INVEST in Bone Health trial suggest significant and similar WL in each group, with good adherence to the weighted vest and exercise prescriptions. Future work will examine treatment effects on several measures of musculoskeletal health.

The impact of CREBRF overexpression in murine hypothalamic AgRP and POMC neurons on energy homeostasis

Neharika Murthy

University of Pittsburgh
Division of Endocrinology, Diabetes, and Metabolism, Department of Medicine, University of Pittsburgh
Research Faculty Mentor: Erin E. Kershaw, M.D., Division of Endocrinology, Diabetes, and Metabolism, Department of Medicine, University of Pittsburgh

Research Collaborators: Ashlee N. Wood
Division of Endocrinology, Diabetes, and Metabolism
Department of Medicine, University of Pittsburgh

Erin E. Kershaw, M.D.
Division of Endocrinology, Diabetes, and Metabolism
Department of Medicine, University of Pittsburgh

Causative genes and underlying mechanisms of obesity, a global health threat, remain largely unexplained despite the high prevalence and heritability of the condition. A novel variant, CREBRF-R457Q, found in Samoans and Pacific Islanders, is associated with an increased risk of obesity but protection from diabetes and other metabolic complications. A causal role for CREBRF in mediating energy and metabolic phenotypes is supported by data from murine models. Specifically, global CREBRF knockout mice have lower body weight and impaired glucose homeostasis, whereas global transgenic CREBRF overexpressing mice are obese with metabolic protection, similar to human CREBRF-R457Q carriers. These data suggest that the variant may be a “gain-of-function” mutation that serves as a “thrifty” gene to promote energy conservation. Obesity results from an imbalance between energy intake and expenditure, the combination of which is referred to as energy homeostasis. POMC and AgRP neurons in the arcuate nucleus of the hypothalamus are critical regulators of energy homeostasis. We, therefore, hypothesized that CREBRF action in Agrp and/or POMC neurons is necessary and sufficient to mediate the effects of CREBRF on energy homeostasis. To test this hypothesis, we generated and evaluated energy homeostasis in murine models with AgRP- and POMC-specific knockout or overexpression of CREBRF. Our results demonstrate the successful generation and validation of these animal models. Although some differences in components of energy expenditure were identified, none of these models fully recapitulated the effects observed in global models, suggesting that other tissues and mechanisms contribute to CREBRF’s effects on obesity.

Smart Technology	1:15 - 2:15 pm	McKenna Hall, Room B02

Leveraging Wearable Technology for Digital Gunshot Detection: An Exploratory Study

Katherine L. Hill
University of Notre Dame
St. Joseph County Cyber Crimes Unit, Idzik Computing & Digital Technologies Program

Research Faculty Mentor: Mitch Kajzer, St. Joseph County Cyber Crimes Unit, Idzik Computing & Digital Technologies Program, The University of Notre Dame

Gunshot Residue Tests (GSR) have witnessed reduced utilization in law enforcement investigations due to in inherent limitations. While GSR may confirm the presences of gunshot residue particles, it cannot determine how these particles were deposited or identify a specific shooter. Considering the limitations of GSR, there is growing interest in exploring alternative approaches to gunshot detection. This presentation explores the potential of wearable technology, specifically the Apple iPhone and Apple Watch, as a means of advancing gunshot detection.

After a series of controlled tests involving firearm discharges while wearing an Apple Watch, we examined the data recorded by both the Watch and the iPhone. This comprehensive analysis encompassed various data artifacts, including GPS coordinates, timestamps, decibel levels, heart rate fluctuations, and accelerometer data. By scrutinizing these digital footprints, our research aimed to determine the feasibility of conducting digital gunshot detection using wearable devices. This presentation discusses our findings, challenges, and the implications of leveraging modern technology for enhancing gunshot detection capabilities, with potential applications in forensic science and public safety.

Generating Virtual On-body Accelerometer Data from Virtual Textual Descriptions for Human Activity Recognition

Zikang Leng
Georgia Institute of Technology
Computer Science
Research Faculty Mentor: Thomas Ploetz, School of Interactive Computing, Georgia Institute of Technology

Research Collaborators: Hyeokhyen Kwon, Emory University, Department of Biomedical Informatics, Thomas Ploetz, Georgia Institute of Technology, School of Interactive Computing

The aim of our research is to enhance human activity recognition using AI models. Typically, this recognition is achieved by using AI to analyze data from small sensors called IMUs, which track movement. However, a major challenge in this field has been the lack of extensive, well-labeled data for training these models effectively. To address this, we've developed an innovative method that significantly improves model training and performance. Our approach begins by generating diverse textual descriptions of various human activities. These descriptions are generated automatically using ChatGPT. We then convert these descriptions into 3D animations that simulate human movements. These animations are further processed to create simulated IMU data, imitating the data that would be captured by actual sensors. This simulated data,

when combined with a small amount of real sensor data, greatly enhances the training of our activity recognition models. We tested our method on three different datasets, known as RealWorld, PAMAP2, and USC-HAD, which are commonly used in this field for performance evaluation. The results were clear: models trained with our new method of simulated data showed significantly better performance in recognizing human activities than those trained with only real sensor data. This work is a significant step forward in the field of human activity recognition. It demonstrates how creating virtual training data can improve model performance without the need for extensive manual data collection. This advancement has potential applications in areas such as health monitoring, sports science, and interactive technology.

International Affairs, Language, & Math Education	1:15 - 2:15 pm	Morris Inn, Hesburgh Room

Adapting the Afterlife: Latin American Reimaginings of Dante's "Inferno"

Harrison Betz
Florida State University
International Affairs / Spanish
Research Faculty Mentor: Dr. Elizabeth Coggeshall, Modern Languages and Linguistics, Florida State University

Adaptation has long been in the toolkit of artists of all media. As each source is taken up by a new cohort of adaptors, the time and place from which these adaptations emerge open novel discourses on the original work and the issues raised within it. In this presentation, I review the adaptive process as it develops around the Dantean character Francesca da Rimini (the memorable seductress of “Inferno V”). Specifically, I interrogate the adaptation of Francesca in cross-cultural references to her in Latin American texts and images from the last century. In doing so, I consider the complex relationship between Latin American and global literatures; specifically, how Latin American creators use the figure of Francesca to position themselves in relation to complex worldwide artistic networks. Addressing this question can also help us to contemplate the adaptive process itself and address notions of global literature and postcoloniality. Ultimately, this project is concerned with how one of the hallmarks of the Italian literary landscape has spread beyond its homeland and the changes it has undergone due to that diffusion.

Addressing Multidisciplinary Challenges with Complex Adaptive Systems Theory

Kaylin Nolan
Georgia Institute of Technology
International Affairs and Modern Languages

Research Faculty Mentor: Dr. Brian Woodall, Sam Nunn School of International Affairs , Georgia Institute of Technology

The increase of globalization has led to an interconnectedness that creates challenges in comprehending dynamics within entities that do not have a central governing authority. This study established the application of Complex Adaptive Systems (CAS) theory as a necessary tool to illuminate platforms that can address critical issues in numerous disciplines (transportation, disaster response planning, and megaregions, etc.) within the regional science field. Using qualitative data from a literature review on CAS theory, the study found multiple fields in which this theory can act as a navigational tool and companion for practitioners attempting to understand vast networks. This study will provide different frameworks, derived from the literature, demonstrating how the application of CAS can expand an entity's sphere of influence in an unrealized space.

Making Mathematics Meaningful: A Mixed-Methods Study of Undergraduate Students' Learning through Social Justice

Hanyi Xu
Syracuse University
Advertising
Research Faculty Mentor: Nicole Fonger, Mathematics, Syracuse University

Research Collaborators: Emanuel Boutros, Mechanical Engineering, Syracuse University; Qiong Wu, Accounting, Syracuse University; and the entire Meaningful Math Research Group, Syracuse University.

This research presents a study on applying Gholdy Muhammad's (2020) historically responsive literacy (HRL) framework in mathematics education at the undergraduate level, through the initiatives of Syracuse University's Meaningful Mathematics Research Group led by Dr. Nicole Fonger. The study analyzed data collected from historically responsive mathematics labs collaboratively designed by high school and college teachers in the Meaningful Mathematics Research Group. These labs aimed to enhance students' comprehension of mathematical concepts and their relevance to societal issues. Through qualitative and quantitative data analyses, we determined that students found the Highway I-81 labs meaningful because they could relate mathematics to a relevant and authentic context and/or feel a sense of geographic awareness or belonging. Significant findings include that 71% of students (n=41) found the labs meaningful, particularly for their ability to link mathematics to real-life and local social issues. The labs promoted a strong sense of locality-identity, helping students view mathematics as a tool for understanding and influencing their surroundings. The study suggests that integrating culturally and historically responsive elements in math education can support student engagement and meaningful learning of mathematics skills. We argue for curricular reforms that prioritize critical literacy and social justice in mathematics education at the undergraduate level.

Oceanic Discoveries	1:15 - 2:15 pm	Morris Inn, Carmichael Room

A PCR-based survey of methane-cycling archaea in methane-soaked subsurface sediments of Guaymas Basin

John Hinkle
University of North Carolina at Chapel Hill
Biology
Research Faculty Mentor: Andreas Teske, Earth, Marine and Environmental Sciences, University of North Carolina at Chapel Hill

Research Collaborators: Paraskevi Mara, Department of Geology and Geophysics, Woods Hole Oceanographic Institution
David Beaudoin, Department of Biology, Woods Hole Oceanographic Institution
Virginia Edgcomb, Department of Geology and Geophysics, Woods Hole Oceanographic Institution
Andreas Teske, Department of Earth, Marine and Environmental Sciences, University of North Carolina at Chapel Hill

The Guaymas Basin in the Gulf of California is characterized by active seafloor spreading, the rapid deposition of organic-rich sediments, steep geothermal gradients, and abundant methane of mixed thermogenic and microbial origin. Subsurface sediment samples from eight drilling sites with distinct geochemical and thermal profiles were selected for DNA extraction and PCR amplification to explore the diversity of methane-cycling archaea in the Guaymas Basin subsurface. We performed PCR amplifications with general (mcrIRD), and anaerobic methanotroph (ANME-1) specific primers that target the alpha (α) subunit of methyl coenzyme M reductase (mcrA). Diverse ANME-1 lineages associated with anaerobic methane oxidation were detected in seven out of the eight drilling sites, preferentially around the methane-sulfate interface, and in several cases, showed preferences for specific sampling sites. Phylogenetically, most ANME-1 sequences from the Guaymas Basin subsurface were related to marine mud volcanoes, seep sites, and the shallow marine subsurface. The most frequently recovered methanogenic phylotypes were closely affiliated with the hyperthermophilic Methanocaldococcaceae, and found at the hydrothermally influenced Ringvent site. The coolest drilling site, in the northern axial trough of Guaymas Basin, yielded the greatest diversity in methanogen lineages. Our survey indicates the potential for extensive microbial methane cycling within subsurface sediments of Guaymas Basin.

Coral Microbiome Distribution and Dynamics at the Cellular Level

Shara Y. Sookhoo

University of Miami
Rosenstiel School of Marine, Atmospheric, and Earth Science
Research Faculty Mentor: Nikki-Traylor Knowles, Rosenstiel School of Marine, Atmospheric, and Earth Science, University of Miami

Research Collaborators: Aliyah True and Nikki Traylor-Knowles (Both at Rosenstiel School of Marine, Atmospheric, and Earth Science)

Stony corals are foundation species for reef ecosystems that host a quarter of the ocean's biodiversity and generate billions of dollars in revenue but are under threat from anthropogenic stressors. While research has mainly focused on the whole organism's response to stressors, little is understood about their response at the cellular level. Corals associate with a diverse community of bacteria which serve vital functions, such as nitrogen fixation, sulfur cycling, and defense against pathogens. Distinct microbial communities within niche coral tissue habitats have been identified. However, it remains unknown whether cellular sub-populations also contain distinct bacterial communities. Furthermore, the impact of cell type on changes within the microbiome has not been investigated. In this study, Pocillopora damicornis was treated with a combination of antibiotics and dissociated into a single cell suspension via airbrush. Cells were sorted into 9 subpopulations based on the natural autofluorescence of Symbiodiniaceae, lysosomes, and reactive oxygen species using fluorescence activated cell sorting (FACS). For each subpopulation, 16S rRNA amplicons were sequenced to identify the members of the bacterial community. Preliminary analyses showed differential distributions of bacteria amongst cell sub-populations. This ongoing research is expected to provide insight into cell subpopulation functions. Additionally, this study will make progress on creating known microbiota corals that can be manipulated to determine the underlying mechanisms for host-microbe relationships.

Assessing oyster reef condition: do characteristics of oyster clusters and sediments tell the same story?

Erin Tilly
Florida State University
Biology and Environmental Science
Research Faculty Mentor: Dr. Josh Breithaupt, Florida State University Coastal and Marine Laboratory, Florida State University

Research Collaborators: Dr. Havalend E. Steinmuller, University of South Alabama, Dauphin Island Sea Lab

After a dramatic decline in 2012, eastern oyster (Crassostrea virginica) populations within Franklin County, FL have yet to recover. The poor condition of subtidal oyster reefs has been well documented due to their industrial importance, but the same cannot be said of intertidal reefs, resulting in limited information on the condition of intertidal reefs during this post-collapse period. Beyond the production of oysters, reefs also function as biogeochemical hotspots,

filtering particulate organic matter from the water column and sequestering a portion into the sediments below. These sediments are rife with nutrient-cycling microorganisms, supporting ecosystems by regenerating nutrients to the water column and burying them in their sediments. Recent studies conducted on intertidal reefs in the Atlantic Coast of Florida have found that dead reefs, determined by the number of live oysters, have significantly lower organic matter and nutrient contents compared to live reefs. Preliminary work on this study compared a sediment core in Apalachicola Bay with the values from these live and dead reefs, finding that buried organic matter and nutrients in our test core were lower than those of dead reefs. This study aims to survey the condition of intertidal reefs across Franklin County by quantifying live oyster density and evaluating the relationships between these oysters and their sediments. Preliminary results indicate that one site is distinct from the rest, with many small oyster clusters resting on the surface but high sediment bulk density which is typical of a dead reef.

Poster Session 2

2:30 - 3:45 pm	Poster Session 2	Morris Inn, Salon Smith Ballroom B

Quantification of Adenine During S-Adenosyl-L-methionine-dependent DNA methylation

Kylie Adams
Wake Forest University
Biochemistry and Molecular Biology
Research Faculty Mentor: Dr. Lindsay Comstock-Ferguson , Department of Chemistry , Wake Forest University

DNA methylation is a vital biological process that regulates gene expression under a host of physiologic and pathologic conditions. This process is catalyzed by DNA methyltransferases, which utilize the universal methyl donor, S-adenosyl-L-methionine (SAM), to catalyze methylation of DNA. Previous experiments identified an N-mustard analog of SAM that replaced the methyl sulfonium with an iodoethyl-functionalized nitrogen. This analog allowed for a specific examination of DNA methylation and was initially successful in experiments with DNA methyltransferase 1. However, when examined with the catalytic subunit of DNA methyltransferase 3A (DNMT3Ac), the mimic was shown instead to be an inhibitor of DNMT3Ac. Thus, in order to explore DNMT3Ac inhibition by the N-mustard analog, an enzyme-coupled assay was developed to quantify DNA methylation through the detection of adenine using a Triple Quadrupole Mass spectrometer. With further research, it was determined that adenine quantification is highly sensitive and its production can be quantitated at low levels, differentiating between catalytic and non-catalytic DNMT3Ac reactions. As a result, optimized methods and quantitation data for DNMT3Ac methylation will be presented.

Angiogenic Biomaterials for Stem Cell Transplantation

Isabella Cozzone
University of Miami
Biomedical Engineering
Research Faculty Mentor: Dr. Courtney Dumont, Biomedical Engineering, University of Miami

Traumatic spinal cord injury (SCI) stems from a compression, dislocation, or penetration to the spine. SCIs cause chronic inflammation at the site and damage to nerve tracts that relay signals up and down the body, disrupting sensory, motor, and autonomic functions. A possible therapeutic for SCI patients is the use of Chromaffin cells for immunomodulation, regeneration, and pain reduction. Due to the inflammatory nature of SCI, the main concern with the success of Chromaffin cell therapy is poor survival post-transplantation. By designing an injectable polyethylene glycol (PEG) hydrogel, we shield the transplanted Chromaffin cells from direct interaction with immune cells and retention at the site of injury. The objective of this study is to characterize and engineer an effective PEG hydrogel for the survival and increased regenerative potential of transplanted Chromaffin cells into an inflammatory environment. The addition of an angiogenic moiety will be evaluated to decipher the effects on the hydrogel's mechanical properties and on the cell's viability and phenotype. Angiogenic composition of the biomaterial will be assessed in a co-culture between chromaffin and endothelial cells. The hydrogel's mechanical properties will be assessed using rheology to determine the storage/loss modulus. The cells will be tested over a two-week time period in vitro for viability, proliferation, and phenotype. Viability will be evaluated using live/dead staining and confocal microscopy. Chromaffin cell phenotype will be assessed via qRT-PCR. Further studies will look into optimizing the integration of the angiogenic moiety to best support the regenerative potential of the Chromaffin cells.

NRVR - Neural in the Virtual

Ava Davis
University of North Carolina at Chapel Hill
Department of Psychiatry
Research Faculty Mentor: Alana Campbell, Psychiatry, UNC-Chapel Hill

Emotion electroencephalography data plays a significant role in EEG-based emotion recognition research. Emotion plays an essential role in cognition and a virtual reality environment provides more depth and bridges the gap between experimental 2-D studies and the real-world. The main research question tackled will be do emotions in the real-world compare to those in virtual reality. Methods include placing participants into a virtual reality environment by using an Oculus - while they simultaneously wear an EEG cap. The information gathered from the EEG cap will be recorded onto EEGLab, where brainwave patterns will help determine the research question at hand. Prior to being submerged into the virtual reality environment, participants will fill out a

GAD-7 Test, Beck's Depression Inventory, and an Assessing Emotion worksheet to gain a gauge of their current state. While in the Oculus, the participant will be exposed to different environments encouraged to provoke varying emotions. The cognitive results conclude that the participants will be able to experience similar emotions in the simulation similarly to real-life ones when exposed to certain environments and situations due to the analysis of EEG data collected.

How the Five Tribes Became "Red": The Failure of Acculturation in the Indian Territory, 1830-1861

Connor B. Diaz
University of Pittsburgh
History
Research Faculty Mentor: Niklas Frykman , History, University of Pittsburgh

In 19th Century America, many marginalized populations employed racialized "othering" pursuant to claiming the American identity for themselves. This article examines the particular use of "othering" by members of the so-called "Five Civilized Tribes" of American Indians—the Cherokee, Choctaw, Chickasaw, Seminole, and Creek—against other indigenous populations pursuant to being perceived as "more American" by their Anglo-American contemporaries. Specifically, it aims to determine why the efforts of the Five Tribes were less successful than those of other populations, namely racialized "white" populations like Irish and German Catholics. A thorough review of primary and secondary sources has revealed that in addition to facing overwhelming racist opposition, the "Five Tribes" found little success counterposing their efforts at "civilization and advancement" against the "wild" Tribes of the Great Plains because the latter group, especially amidst the transition to wage labor and the subsequent evolution of republican thought, were the subjects of a renewed fervor of fetishization among Eastern intellectuals in the middle of the 19th Century. This conclusion and others made in the paper are significant insofar as they bear relevance to how the "American" identity has historically been formed and offer a comprehensive review of the actions of the Five Tribes in this period that both affords them a significant degree of agency and fills in the gaps in the existing literature on the topic. Moreover, unlike much of this existing literature, this paper operates with a clear yet fluid definition of what it meant to be "white" in the nineteenth century.

Iron-sulfur Cluster Assembling Thioredoxin from Methanocaldococcus jannaschii

Maddie Ferguson
Virginia Polytechnic Institute and State University
Biochemistry
Research Faculty Mentor: Dr. Biswarup Mukhopadhyay, Biochemistry and Genetics, Bioinformatics, and Computational Biology, Virginia Tech

Research Collaborators: Stephen Trampe (Virginia Tech, Biochemistry), Christian Heryakusuma (Virginia Tech, GBCB), Dr. Biswarup Mukhopadhyay (Virginia Tech, Biochemistry and GBCB)

Methanocaldococcus jannaschii (Mj), is a chemolithoautotrophic, hyperthermophilic, strictly anaerobic, methanogenic archaeon, containing a simpler thioredoxin (Trx) system with two thioredoxins, MjTrx1 and MjTrx2. Thioredoxins are small acidic proteins present in all domains of life, acting as a redox regulator of metabolism through protein cysteine disulfide bond reduction activity. MjTrx2 is non canonical, reducing cysteine disulfide bonds poorly. During purification of a recombinant form produced with a His-Tag in Escherichia coli, the protein was found with a brown color that quickly disappeared. We hypothesized that MjTrx2 formed an iron-sulfur cluster that was either oxygen sensitive or removed by Ni2+-NTA chromatography. To test this hypothesis, MjTrx2 was expressed with a Strep-Tag in E. coli aerobically followed by both aerobic and anaerobic purification. The anaerobically purified protein had a slightly stronger signal for the iron-sulfur cluster based on the UV-visible spectrophotometry analysis. We concluded that the iron-sulfur cluster was not removed by Ni2+-NTA chromatography but was oxygen sensitive. To prevent aerobic degradation, MjTrx2 was being expressed in E. coli anaerobically purified anaerobically. A plasmid-based system containing the E. coli narG promoter and nitrate induction were employed for anaerobic expression of MjTrx2 with a Strep-tag. A concentration of 0.1% for glucose and 50 hours of cultivation were found optimal for a high level of MjTrx2 production. We are currently producing MjTrx2 for EPR analysis and constructing a hyperthermophilic aconitase assay for detection of potentially novel hyperthermophilic Fe-S cluster assembly systems.

Predicting Injuries through Pose Estimation: A Biomechanical Analysis of Fatigue in Track and Field Athletes

Dan Griffiths
Syracuse University
Sport Analytics
Research Faculty Mentor: Dr. Rodney Paul, Sport Analytics, David B. Falk College of Sport and Human Dynamics at Syracuse University

This study introduces a pose estimation model, leveraging artificial intelligence and computer vision, to analyze biomechanical changes in track and field athletes due to fatigue. The primary aim was to investigate how fatigue influences athletes' movement patterns, potentially leading to injuries and performance degradation. The results showed notable shifts in joint correlations, particularly between the ankles and shoulders, and the knees and shoulders, indicating compensatory movements due to fatigue. Variations in the cyclical asymmetry index and forward lean angles further pointed towards fatigue-induced changes in knee movement and posture. These findings were complemented by a decrease in average step length across laps, highlighting a shift to more sustainable running patterns as fatigue set in. Temporal consistency scores improved over time, implying that athletes maintained stable movement patterns despite

fatigue. This suggests a high level of adaptability in the athletes' biomechanical strategies to cope with the increasing physical demands of the task. This research highlights the potential of AI-driven pose estimation in sports science, offering valuable insights for enhancing training plans, preventing overtraining, optimizing peaking, and reducing injury risks in athletics. It underscores the importance of continuous monitoring of athletes' biomechanics, not just in competition but also during training. By integrating AI and computer vision into sports science, coaches and athletes gain access to a powerful tool for bio-mechanical analysis, enabling more informed decisions to enhance performance and prevent injuries. This study paves the way for more sophisticated and personalized training programs, tailored to the individuals bio-mechanical profiles and fatigue responses.

An Exploration of How Gut Microbiota Influences Early Life Neurogenesis in Drosophila Melanogaster

Crystal Guerrero
University of Virginia
Human Biology, DMP
Research Faculty Mentor: Sarah Siegrist, Biology, University of Virginia

Neurogenesis, the proliferation and differentiation of neural stem cells, plays a pivotal role in early developmental stages and overall organismal health. Previous work has revealed that the microbiome, a collection of naturally-occuring gut microbes, may influence neurogenesis, through a pathway called the gut-brain axis. However, we still know very little about the nature of this interaction. This project seeks to understand the gut-brain axis with the model organism Drosophila Melanogaster. Shortly after larval hatching, neural stem cells (NSCs) begin proliferation in response to nutritional cues. I first sought to determine whether depletion of the larval microbiome would have an effect on the timing of NSC proliferation at 24 hrs after hatching. The depletion protocol included simultaneous introduction of a streptomycin (antibiotic) diet, dechorination (removal of the chorion) of eggs, and an aseptic technique (as a sterile field was not vital). Control animals have revealed a rough average for stem cell reactivation.Test experiments are still underway, but we expect microbiome-depleted flies to exhibit variation in NSC proliferation. This study hopes to elucidate any relationship between the gut microbiota and neurogenesis, opening new avenues for inquiry about the mechanism of the gut-brain axis and what could be considered to be an ideal microbiome. Studies have shown that the health of a pregnant mother's microbiome has effects on the expected child's development. Consequently, this study may advocate for improved prenatal care that addresses gut microbiota imbalances and its associated consequences, particularly in the context of embryonic neural development through the gut-brain axis.

Patterns of Hallucinogen Use Among Individuals with Social Anxiety Disorder

Richard Alexander Hilpert

Florida State University
Psychology
Research Faculty Mentor: Dr. Jesse Cougle, Psychology, Florida State University

Research Collaborators: Dr. Jesse Cougle, Florida State University, Department of Psychology and Tapan Patel, Florida State University, Department of Psychology

Social anxiety disorder (SAD) is amongst the most prevalent psychiatric disorders, but current research has not examined patterns of hallucinogen use (HU) among individuals with SAD. The aim of this study was to examine the relationship between HU and hallucinogen use disorder (HUD) with symptoms of SAD in a large sample of individuals with SAD. Participant (N = 1255) data were derived from the third wave of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). We hypothesized that within individuals diagnosed with SAD, past year and lifetime HU would be associated with social anxiety symptomology such that individuals who endorse HU would endorse significantly fewer social anxiety symptoms. Further, we hypothesized that individuals who are diagnosed with HUD would endorse greater SAD symptoms compared to individuals without HUD. Contrary to predictions, we found lifetime HU ($p = < 0.001$) to be associated with greater SAD symptom severity even after covarying for demographic factors. Consistent with predictions, we found lifetime HUD ($p = .012$) to be positively associated with SAD symptom severity. We were unable to run analyses on past-year variables due to a lack of statistical power. This study highlights the importance of future longitudinal and experimental investigation into the relationships between HU and SAD.

Generating Multilayer Polyelectrolyte Coating Libraries on Protein Nanoparticles for Mucosal Delivery

Sarah Jenison
Georgia Institute of Technology
School of Chemical and Biomolecular Engineering
Research Faculty Mentor: Julie A. Champion, School of Chemical and Biomolecular Engineering, Georgia Institute of Technology

Research Collaborators: Thomas Pho, Julie A. Champion

The efficacy of nanoparticle therapeutics is greatly limited by biological barriers that hinder access to intended sites. One biological barrier that has yet to be overcome is the mucus layer, which covers epithelial surfaces throughout the body. Mucus is a viscoelastic gel that restricts movement of most foreign matter, including beneficial material such as nanoparticles. Conventional therapeutic nanoparticles have adhesive interactions within the mucus layer that hinder mobility. To enable mucus-penetration, polyethylene glycol (PEG) is commonly used as a surface coating for improved diffusion across the mucus barrier. However, we have demonstrated that PEG coatings on protein nanoparticles elucidate off-target immune responses through the production of anti-PEG antibodies. In this study, we developed a library

of protein nanoparticles with different multilayer-polyelectrolyte coatings that modulate diffusion in mucus as an alternative to PEG coatings. We have formulated over 30 unique nanoparticles and screened them for enhanced diffusion coefficient using Nanoparticle Tracking Analysis (NTA) in mucus. NTA revealed that certain formulations had significantly improved diffusion coefficients. In addition, we screened four cell lines derived from colorectal, lung, cervical epithelial tissue, and dendritic cells using flow cytometry to assess their uptake profile with a mucosal barrier. We identified formulations with improved interaction with different cell lines, linking unique polyelectrolyte coatings with specific cell types. These experiments indicate that certain multilayer polyelectrolyte formulations have the potential for improved diffusion and increase cellular uptake delivery in mucus enriched cells.

The Role of the CXCL13-CXCR5 Chemokine Axis in Regulatory CD8+ T Cell Trafficking

Zachary Joseph
University of Notre Dame
Department of Mathematics
Research Faculty Mentor: Dr. John Choi, Department of Renal Medicine, Harvard Medical School

Research Collaborators: Jamil Azzi, M.D., Ph.D., Division of Renal Medicine, Brigham and Women's Hospital;
John Choi, M.D., Division of Renal Medicine, Brigham and Women's Hospital

Preventing rejection of organ transplants for the duration of recipients' lives remains a challenge, with the average lifespan of transplanted organs stagnating over the last thirty years. Rejections that occur long after transplantation are often antibody-mediated. As antibodies are produced by B cells, interventions that specifically target B cells that produce anti-graft antibodies may help extend graft survival. One such therapy uses a subset of killer T cells, which usually kill cancer, to interfere with B cell development. These cells are known as CD8 Tregs. As B cells develop in germinal centers (microstructures within lymph nodes), the trafficking of CD8 Tregs is vital to their function. However, the chemokines that control CD8 Treg trafficking remain poorly understood.

To study this, we began by counting the mRNA transcripts from purified CD8 Tregs and a similar subset of T cells. We found that mRNA transcripts for the chemokine receptor CXCR5 were enriched in CD8 Tregs. We then used single-cell fluorescent labeling of CXCR5 to determine protein expression. We found that CD8 Tregs expressed more CXCR5 than other cells, and that CD8 Tregs from mice who had undergone heart transplants expressed more CXCR5 than their naive counterparts. To determine the functional impacts of these differences, we used cell migration assays. Preliminary results indicate that CD8 Tregs migrated strongly and specifically towards the chemokine that binds to CXCR5. These data suggest that CXCR5 plays a role in CD8 Treg trafficking and sets the stage for in vivo studies of its ability to fight rejection.

Gender Disparities in Depression: Reviewing the Sociocultural Contributions in Working Women's Mental Health Struggle

Melina Lavarone
Syracuse University
Psychology
Research Faculty Mentor: Afton Kapuscinski, Psychology, Syracuse University

This literature review investigates the idea that sexist and discriminatory beliefs and practices play a role in working women experiencing depressiveness at higher rates than men. The purpose was to determine whether the literature supports the idea that specific psychosocial factors help explain the disparity: 1) socialization patterns that instill senses of inferiority, such as social pressures, gender roles, and meta-stereotypes, 2) inequalities experienced by women, including the division of unpaid labor and discrimination and unequal treatment in the workplace, and 3) how these elements perpetuate the gender wage gap, contributing to economic disadvantages that may amplify risk for depression. Policy recommendations are also discussed. The motivation is to identify roots so that policymakers, leaders, and healthcare professionals can optimally combat the discrepancy. The literature on meta-stereotypes indicates an indirect association with depression in working people. Early exposure to negative gender stereotypes about women and girls is correlated with depressiveness. The literature on social pressures strongly supports gender-based socializations' effect on girls' and women's mental health, while the literature on gender norms moderately supports this connection. The association between workforce inequality and the gender disparity is strongly supported by the literature on discrimination in the division of labor and the pay gap. Experiencing sexual harassment is associated with increased depressive symptoms and disorders. There is strong support that COVID-19 impacted women's mental health more negatively than men. Implications include the workforce being under-researched regarding depression disparities, controversial self-esteem measurement techniques, limited population samples, and inconsistency in important terms and definitions.

Keywords: Gender disparity, workforce, depression, mental health

---

An Analysis of Active Galactic Nuclei in Diverse Galactic Environments.

Divya Patel
University of Louisville
Department of Physics
Research Faculty Mentor: Dr. Benne Holwerda , Department of Physics, University of Louisville

Research Collaborators: Dr. Benne Holwerda (University of Louisville, Department of Physics)
Clayton Robertson (University of Louisville, Department of Physics)

We examine the active galactic nuclei (AGNs), where the active supermassive black holes reside. Using the Galaxy and Mass Assembly (GAMA) survey data, our main goal is to search three regions of space—filament, tendril, and void space—for AGNs. Active black holes are notorious for their violent activities through space, as they intensely spew out amounts of matter. Such behavior can be observed using the Baldwin-Philips-Terlevich (BPT) diagrams, which use ratios of emission lines to understand the astrophysical characteristics of various objects. To enhance the precision of our BPT diagrams, we focus on the red part of the spectrum, which minimizes the confounding effect caused by dust. Additionally, we employ a single-to-noise ratio (S/N) greater than 3, which discards unreliable data and improves accuracy. In this research, we investigate the causes behind the higher concentration of black holes in one type of surroundings compared to the other. This requires a thorough examination of the galactic surroundings using various physical and statistical techniques. In particular, this helps us understand the morphology of neighboring galaxies and stars. The analysis of data suggests that the ratio of AGNs to galaxies remains approximately the same in all three environments. This opens a room for questions on why the void space, where there are fewer galactic interactions, maintains the same ratio of AGNs to galaxies.

Wireless Non-invasive Activation of Neuron Action Potentials with Magnetoelectric Nanoparticles

Aidan Scott-Van Deusen
University of Miami
Biomedical Engineering
Research Faculty Mentor: Dr. Sakhrat Khizroev, Electrical and Computer Engineering, University of Miami

Research Collaborators: Elric Zhang, Department of Electrical and Computer Engineering, University of Miami, Coral Gables, FL, USA.

Max Shotbolt, Department of Biomedical Engineering, University of Miami, Coral Gables, FL, USA.

Shawnus Chen, Department of Chemical, Environmental and Materials Engineering, University of Miami, Coral Gables, FL, USA.

Ping Liang, Professor-Emeritus of Electrical and Computer Engineering, University of California, Riverside, CA 92521, USA.

Sakhrat Khizroev, The Miami Project to Cure Paralysis, Department of Biochemistry and Molecular Biology, Department of Electrical and Computer Engineering, University of Miami, Coral Gables, FL, USA.

Magnetoelectric nanoparticles (MENPs) are a recent development in the field of neuroscience, providing a non-invasive, wireless alternative to current brain-machine interfaces. Unlike other techniques, using MENPs achieves high spatial and temporal resolutions without the need for genetic modification. MENPs' potential to provide targeted deep brain stimulation has been demonstrated in both in vitro and in vivo studies. In this study, the ability to trigger local neuron action potentials has been shown using MENPs and AC magnetic fields. As we continue to improve this technology, we hope to develop methods of both wirelessly reading and writing information to the brain. To record brain activity using MENPs, we will need to integrate the technology with established high-resolution magnetic resonance imaging (MRI) systems or a more novel approach such as magnetic particle imaging (MPI). Other challenges for this technology include optimizing the magnetoelectric effect of the nanoparticles, targeting the neuronal membrane, preventing particles from sticking together, and precise magnetic field energy localization. Despite these challenges, the potential of MENPs to enable two-way wireless communication with the brain warrants further research. With this possibility in mind, MENPs have the potential to revolutionize neurological medicine and shed light on the nature of the human brain.

Insights from Animal-Associated Bacteria in New York African Burial Ground Samples

Justice Skinner
North Carolina State University
Animal Science
Research Faculty Mentor: Dr. Carter Clinton, College of Sciences, North Carolina State University

Research Collaborators: Varun Gudhe, North Carolina State University (NCSU), Computer Science Department

This project analyzes burial soil samples from the historic New York African Burial Ground (NYABG), where the remains of over 400 African Americans were discovered in 1991 in Lower Manhattan, New York. Previous studies include an analysis of a highly conserved gene present in bacterial species (16S rRNA gene) that identified all human-associated bacteria in sixty-six soil samples. Using this dataset, we aim to build on this analysis to identify all bacterial species associated with animals, providing information about animals of the New Amsterdam Colony, their domestication status, and possible roles as livestock.

First, we reviewed the comprehensive list of generated metadata sequences, containing partial-to-complete taxonomic information for each sequence. To pinpoint bacterial sequences related to animal contributions, we filtered and sorted the data by phylum. Python was employed to organize the data into the 12 most abundant phyla, prioritizing DNA sequences with genus and species assignments within each phylum.

Thus far our findings have confirmed zoonotic diseases such as tetanus, caused by Clostridium tetani (Lotfollahzadeh et al., 2018), campylobacteriosis caused by Campylobacter spp. (Knipper et al., 2023), and MRSA, caused by Staphylococcus spp. (Mencía-Ares et al., 2021). These diseases are related to animals such as sheep, cattle, and swine respectively. The findings of this research can potentially inform us about the lived experience of the historical NYABG population including domestication practices and the presence of post-colonial zoonotic diseases which impacted this population along with conservation strategies for the disappearance of the animal species in present-day New York City.

Kinetics of TNFRSF25 (DR3) RNA expression after T Cell Receptor Activation in an in vitro Murine Model

Caleb Stacey
University of Miami School of Medicine
Department of Microbiology and Immunology

Research Collaborators: Henry Barreras, University of Miami School of Medicine; Dietlinda Wolf, University of Miami School of Medicine & Sylvester Comprehensive Cancer Center, Gina Adams, University of Miami School of Medicine; Robert Levy, University of Miami School of Medicine & Sylvester Comprehensive Cancer Center

Tumor necrosis factor receptor superfamily 25 (TNFRSF25), also known as death receptor 3 (DR3), is a cell surface co-stimulatory receptor found primarily in lymphocyte rich tissue and is involved in the regulation of apoptosis and lymphocyte homeostasis. We explored the kinetics of TNFRSF25 expression following T cell activation. Unfractionated peripheral lymph node (pLN) and spleen (SPL) cells of B6 Thy1.1 mice were collected. 2x106 cells, 2.0μg αα-CD3, and 1.0μg αα-CD28 were plated in each well of a 24 well plate for T cell receptor (TCR) stimulation. Total RNA was isolated, converted to cDNA, and rt-qPCR was performed using TaqMan probes. TNFRSF25 in pLN cells rapidly increased within the first 6 hours of stimulation, peaked at 24 hours, and decreased through 72 hours. TNFRSF25 in 6 hours stimulated cells remained unchanged, increased at 18 hours, peaked at 24 hours, and decreased through 72 hours. TNFRSF25 RNA was identified in pLN (n = 6) and SPL (n = 2) cells. TNFRSF25 production in SPL cells appeared to be induced more slowly in comparison to pLN cells. This may reflect a lower percentage of T cells in the spleen versus lymph nodes. These results show that TNFRSF25 RNA can be rapidly detected in spleen and lymph node cells following in vitro TCR stimulation. RNA levels diminish 72 hours after the introduction of TCR stimulants. Subsequent studies will examine the kinetics of RNA and protein expression in vivo to promote development of in vivo TNFRSF25 targeting strategies for treatment of immune mediated disorders.

First-Year Engineering Students and GenAI: Experience, Attitudes, Trust, and Ethics

Elisabeth Thomas
University of Louisville
Department of Industrial Engineering
Research Faculty Mentor: Dr. Campbell R. Bego, Department of Engineering Fundamentals ,
University of Louisville

Research Collaborators: Cenetria L. Crockett, University of Louisville, Department of Anthropology
Dr. Campbell R. Bego, University of Louisville, Assistant Professor, Department of Engineering Fundamentals

Generative AI (GenAI) has the potential to benefit student learning by offering personalized feedback, idea generation, research, writing aid, and administrative/analysis support. However, if used inappropriately, the same tools can lead to false/biased content creation and reduced ethical awareness leading to possible academic dishonesty and privacy issues. At this early stage, ethical standards and professorial guidance are unavailable, thus it is important to understand what students are thinking about the recent technologies.

This current study measured student participants' (N = 441) prior experience, attitudes towards, trust in, and ethical opinions of ChatGPT. The survey was given at the beginning of the Fall 2023 first-semester engineering course at the University of Louisville. Results indicated that attitudes varied widely across the student sample, with some considering it a benefit to society and others considering it a detriment. Experience levels positively correlated with all measures, indicating that students who have embraced it have more positive attitudes. Importantly, this trend regarding student's ethical disposition is shown in figures 1 and 2 on the poster presentation. These results indicate that both the excitement and concern from the higher education community are warranted, and that students need training and clear ethical guidance toward using GenAI in college.

Recapitulating the Microenvironment of the Heart using Decellularized Extracellular Matrix derived from porcine heart

Tanya Upadhyay
North Carolina State University
Biological Sciences
Research Faculty Mentor: Jessica Gluck, Textile Engineering, Chemistry and Science, North Carolina State University

Research Collaborators: Kiran Mumtaz Ali - North Carolina State University: Textile Engineering, Chemistry and Science; Dr.Jessica Gluck- North Carolina State University: Textile Engineering, Chemistry and Science; Tavila Sharmin- North Carolina State University: Industrial and Systems Engineering

Global mortality rates reveal that heart attacks are the number one cause of death. The heart possesses minimal regeneration capability, and there is a scarcity of surgical interventions designed to compensate for the loss of cardiac tissue. This emphasizes the importance to research treatments capable of rejuvenating the heart's original function and structure.At the

microscopic level, the heart tissue encapsulates cardiomyocytes and numerous proteins within its extracellular matrix (ECM). Research studies have defined the role of the heart's ECM, as primarily providing mechanical support to the tissue. To further investigate the intricate functions of this complex ECM, we have conducted experiments involving decellularization methods, aiming to extract the natural ECM from a porcine heart. The ECM as a biomaterial is very diverse. We have formulated a bioink derived from the ECM for 3D bioprinting, due to two key reasons: 1. The ECM constitutes a chemically similar environment to the native heart. 2. The 3D bioprinting process replicates the mechanical integrity found in the native heart tissue. We have successfully demonstrated the significance of the ECM in cell survival and cell growth, by culturing mouse cells within an ECM based 3D hydrogel. Our overall objective is to explore the potential of ECM-derived hydrogel in guiding the differentiation of stem cells into cardiomyocytes. Ultimately, this will create a mechanically stable and biofunctional 3D construct that mimics the heart's microenvironment, with the ability to be used in treating heart disease.

Escaping the Vietnam Quagmire: Johnson, Nixon, and America's Rough Road to Paris

Rongwei Zhu
Boston College
International Studies; History
Research Faculty Mentor: Jennifer Erickson, Political Science , Boston College

In recent decades, the subject of war initiation has received profound scholarly attention. In comparison, the puzzle of when and why states choose to end wars remains largely understudied. This thesis seeks to contribute to the greater academic discussion of when major powers choose to withdraw their troops from a conflict they deem to be losing, with important implications for scholarship and policy alike. In approaching the central question of troop withdrawal, this thesis will examine US behavior and decision-making on three separate occasions during the Vietnam War, utilizing primary documents collected from two archives and Foreign Relations of the United States (FRUS), biographies and autobiographies, a number of interviews, and extensive secondary literature on the subject. The United States had numerous occasions to withdraw its troops from Vietnam prior to 1973. Yet despite facing mounting military and political costs, substantial public pressure, and Congressional opposition, Washington refused to do so for years , making Vietnam a particularly puzzling case. Without an in-depth examination of policymakers’ debates and decisions through primary source documents in particular, however, scholars and policy experts risk misinterpreting the case and perhaps overestimating domestic factors in what I show is a much more complex and nuanced decision process. Focusing on the roles of public opinion, election cycles, bureaucratic politics, and perceptions and credibility, I offer a holistic view of the factors that both prevented and propelled Washington’s decision to withdraw from Vietnam from 1964 to 1973.

Oral Session 3

Cellular Exploration	4:00 - 5:00	McHenna Hall, Room 202

Functional investigation of a bacterial fusion protein

Steven Cayea
Wake Forest University
Biochemistry and Molecular Biology
Research Faculty Mentor: Dr. Rebecca Alexander, Chemistry, Wake Forest University

Aminoacyl tRNA synthetases (aaRSs) are a family of enzymes that covalently attach an amino acid to the correct tRNA for the process of translation. At times, these enzymes have evolved to have an added domain associated with them that expands their function beyond the attachment of the amino acid to tRNA. In Mycoplasma penetrans, a species of bacteria that infects the human urogenital and respiratory tracts, primarily in HIV-positive individuals, there is an additional aminotransferase domain (ATD) specifically appended to its methionyl-tRNA synthetase (MpMetRS). The ATD facilitates the synthesis of methionine within the methionine salvage pathway by adding an amino group to 2-keto-4-methylthiobutyrate (KMTB). This process is believed to prevent competition with host cell proteins by shuttling newly-synthesized methionine to the MetRS domain. In addition to the aminotransferase domain and the synthetase domain, there is also a small N-terminal domain of 166 amino acids that does not share a sequence with any known protein. Various modified MpMetRS gene variants were constructed to isolate specific domains, which were subsequently purified as proteins for further analysis of their functions. This project evaluated the efficiency of these domains to catalyze the methionylation of M. penetrans tRNA through different assays with radiolabeled methionine and radiolabeled tRNA. Work has shifted to understanding the in vivo cellular activity of MpMetRS in the context of a bacterial system that is defective for methionine biosynthesis, such as E. coli B834 cells.

Characterization of Rab34 across cell types and cell cycle stages

Elijah Springer
Syracuse University
Biotechnology, College of Arts & Sciences
Research Faculty Mentor: Dr. Heidi Hehnly, Biology Department, Syracuse University

Rab GTPases function as molecular switches by regulating membrane trafficking and vesicular transport among cellular compartments. They recruit membrane transport regulators known as Rab effectors to deliver material to the apical plasma membrane and establish the polarity of secretory and endocytic pathways. Certain Rab proteins have been shown to regulate

cytokinesis and abscission through polarized membrane transport to the basolateral membrane. Rab34 is an interesting GTPase to investigate because while it has not been directly linked to polarity establishment, it has been reported to localize to the Golgi apparatus and the centrosome, two organelles implicated in epithelial polarity. Several studies show that Rab34 mediates trafficking events required for the formation of cilia, which are sensory organelles that transmit extracellular cues to the cell's interior. This is significant because defects in the assembly and function of cilia give rise to a group of genetic disorders known as ciliopathies. Given Rab34's potential involvement in polarity, specific cell types warrant investigation. Epithelial cells are of particular interest to me due to their well-defined apical and basolateral domains, providing a robust model to study Rab34's function. Using mammalian cell cultures, I found that Rab34 localizes to ciliary proteins at various stages of the cell cycle, demonstrating that the protein may be able to coordinate ciliary dynamics in conjunction with cell cycle progression. Altogether, this study aims to determine if Rab34 contributes to the development and function of polarized tissues.

Understanding Mechanisms of Cancer Cell Killing by Novel Copper Containing Complexes

Preeti Tanwani
University of Louisville
Biology and Neuroscience
Research Faculty Mentor: Dr. Levi Beverly, Medicine: Division of Medical Oncology and Hematology, University of Louisville

Research Collaborators: Calista R. Dean, University of Louisville, Department of Medicine
Theresa Weis, University of Louisville, Department of Medicine
Alexis A. Vega, University of Louisville, Department of Medicine
Robert M. Buchanan, University of Louisville, Department of Chemistry
Craig A. Grapperhaus, University of Louisville, Department of Chemistry
Haixun Guo, University of Louisville, Department of Radiology
Levi J. Beverly, University of Louisville, Department of Medicine

Cancer treatment plans traditionally consist of chemotherapy and radiation. Recent focus has been put towards finding cancer specific drug targets to allow for more beneficial disease management and better patient care. We are studying a class of copper compounds that specifically target cancer cells in the hopes of bringing these compounds to clinical trial. Through experimentation with multiple cell lines– including lung carcinoma, neuroblastoma and leukemia– we are working to understand the mechanism of how these drugs are killing cancer cells. It is hypothesized that copper compounds are killing cancer cells via a subtype of apoptosis known as Cuproptosis. Cuproptosis is a specific copper-mediated cell death, induced by copper (II) elesclomol. It is important to uncover the mechanisms of this pathway to develop precise treatments. Viability assays were used to uncover potentially clinically relevant doses for various copper complexes used for drug treatment, such as CuATSM, CC101, NV3104, and NV30189. The dosage response curves for A549 lung adenocarcinoma cells were then used to

perform multiple western blots investigating markers related to cell death, EGFR signaling, and autophagy to further understand the mechanism of cancer cell killing. It was concluded that modification of copper complex composition results in altered IC50 values, CuATSM and CC101 exhibit HSP70 upregulation, and copper drug leads to both EGFR and ERK activation by phosphorylation. We thank the National Cancer Institute grant R25-CA134283-10 and Kosair Pediatric Cancer Program for the funding support.

Neuroscience & Development	4:00 - 5:00 pm	McHenna Hall, Room B01

Association Between Area Deprivation Index and Outcomes After Subarachnoid Hemorrhage

Michelle Chung
University of Pittsburgh
Nursing
Research Faculty Mentor: Elizabeth Crago, Department of Acute and Tertiary Care, University of Pittsburgh

Research Collaborators: Michelle Chung SN Department of Acute and Tertiary Care, Zhirui Deng MS Department of Health Promotion, Diaxu Ren PhD Health and Community Systems, Kelly Isola SN Department of Acute and Tertiary Care, Elizabeth Crago RN PhD Department of Acute and Tertiary Care

Subarachnoid hemorrhage (SAH), a life-threatening hemorrhagic stroke, often leads to long-term disabilities and poor quality of life (QOL). Individuals in more advantaged neighborhoods generally report higher QOL post-stroke, but limited information exists on QOL and neighborhood data after SAH. This study examined the relationship between neighborhood data using the area deprivation index (ADI), functional outcomes, and QOL at 3- and 12-months after SAH at a single stroke center. General outcome was assessed using modified Rankin scale (mRS) and physical QOL (PCS) using 20 items of the 36-item short form survey (sf36). The ADI, obtained using the University of Wisconsin School of Medicine Neighborhood Atlas and patient zip codes, indicated increased deprivation with higher scores. Demographic and clinical data were obtained from the patient, chart, or caregiver, and outcomes were determined through interviews.

In a retrospective analysis of 215 SAH patients (mean age 54 years, 76% female, 84% white), logistic and linear regression models examined ADI measures (state decile, national percentile), controlling for stroke severity, age, race, and gender. Significant relationships between ADI measures and PCS were identified at both 3 and 12 months post-SAH. A one-unit increase in ADI correlated with a -3.711 change in 3-month PCS ($p<0.001$) and a -4.364 change in 12-month PCS ($p<0.001$). However, no relationship was found between ADI measures and mRS at 3 or 12 months.

This analysis suggests that individuals from more deprived areas report poorer physical QOL, as measured by the sf36. Targeted interventions for patients in such areas warrant investigation.

The Influence of Harsh Parenting and Maternal Depression on Executive Function in Early Childhood

Julia Davis
Duke University
Neuroscience
Research Faculty Mentor: Dr. Kenneth Dodge, Professor of Psychology and Neuroscience, Duke University

Research Collaborators:
Dr. Ken Dodge, Department of Psychology & Neuroscience, Duke University
Dr. Ben Goodman, Research Scientist Center for Child and Family Policy, Duke University

The environment that a child grows up in has an important impact on neurodevelopment. Specifically, previous research has demonstrated that parenting behaviors and parent-child interactions influence the development of executive function (EF). EF is associated with a wide variety of positive outcomes in childhood and beyond, including academic achievement and social and emotional stability. In the present research we focused on two fundamental EF skills: attention, and inhibitory control (IC). We investigated the relation of harsh parenting and maternal depression at 30 months with EF (attention and IC) at 30 and 42 months using a combination of parent self-report and research observation data from the Family Connects (FC) early childhood intervention. FC is a short-term, postnatal universal nurse home-visiting program that identifies family-specific needs and connects families with community resources to address their needs. Harsh parenting and maternal depression at 30 months are significantly associated with poorer IC and attention at both 30 and 42 months, after controlling for medical risk at birth, child gender, child race/ethnicity, socioeconomic status, maternal age, and maternal education. These results shed light on the relation between parenting behaviors and EF, suggesting that harsh parenting behaviors and parent mental health challenges may negatively impact neurodevelopment. Further, these results may be a foundation for the design of early childhood interventions or policies aimed at promoting healthy parent-child interactions and early cognitive development.

Are Dads Necessary? The Father's Role in the Development of Offspring Behavior

Trisha Maheshwari
University of Virginia
Department of Psychology, UVA
Research Faculty Mentor: Allison Perkeybile, Department of Psychology, University of Virginia

Research Collaborators: Hinton, TD., Perkeybile, AM., Connelly JJ. Department of Psychology, University of Virginia

Like humans, prairie voles (Microtus ochrogaster) are naturally socially monogamous and raise their young in pairs, frequently with older offspring as alloparents. In cases of paternal absence, offspring often show developmental deficits in species-typical social behaviors. Therefore, it is important to understand fathers' roles toward offspring development, the effects of paternal care loss, and compensation alternatives. To understand the difference between care from fathers versus non-paternal males, we compared early life care under four parenting conditions, biparental care, maternal only, maternal and older sister, and maternal and older brother. In adulthood, one male and one female offspring were tested for spontaneous alloparental care and partner preference formation. We anticipate offspring in the biparental group will show species-typical alloparental care of offspring and form a pair bond with an opposite-sex partner, while offspring reared by a single mother will show deficits in alloparenting and pair bonding. We also anticipate that rearing by a mother and older sister will rescue pair-bonding behavior in female offspring only, and rearing by a mother and older brother will likewise rescue pair-bonding behavior in male offspring only. If this is the case for the two mother plus alloparent-reared groups, it suggests that a same-sex alloparent is a viable alternate 'parent' for offspring when the father is not present. Alternately, if male offspring show deficits in pair bonding after rearing by a mother and older brother, this may be potential evidence that fathers possess some innate father-specific quality that cannot be replicated by an alloparent.

Music & Narrative	4:00 - 5:00 pm	McHenna Hall, Room B02

Ready When You Are: An Autobiographical Concept Album

Kat Hammock
University of Virginia
Music
Research Faculty Mentor: Karl Miller, Music, University of Virginia

Research Collaborators: A special thank you to Daniel Oldham, Orion Faruque, and Johan Glidden for producing the songs on the album, and to Professor Karl Miller and Professor Michael Slon from UVA's McIntire Department of Music, who served as my project advisors.

This album is an exploration of my life thus far. It is a full-length recorded autobiographical concept album of original songs that I wrote, composed, and performed.

I have been writing original music since I was 14, and released my debut album, "Better Than I've Been" in Fall 2022. My pursuit of music has led to opportunities like being a semifinalist on NBC's "The Voice" and performing on stages like Lincoln Center and Carnegie Hall.

This project is my sophomore album. All nine songs were written about my life experiences, and how my perspective on these experiences has changed over time. These songs, placed together, serve as a reflection of my life thus far, and my hope for the future. The topics of the songs range from a song about my faith, to my dad's hometown, to my complicated relationship with my artistry.

My goals in creating the project were to hone my skills as a singer/songwriter/musician, gain a deeper understanding of/appreciation for the experiences in my life that have shaped me, and to bring joy/consolation to the audience that listens to the album.

Through creating the project, I hope to help others appreciate the good and challenging moments that have shaped their own lives.

The album is tentatively set for release on all platforms on April 26th.

Soundscapes throughout Madrid, capital of the Kingdom of Spain.

Juan C. Londoño
Wake Forest University
Economics, Philosophy
Research Faculty Mentor: Dr. Elizabeth A. Clendinning, Department of Music, Wake Forest University

Research Collaborators: Wake Forest University Scholars Program

This project works on making Soundscapes of different districts throughout the city of Madrid, Spain in order to get a more holistic understanding of the culture and society of Madrid - a historically powerful and significant city internationally. Soundscapes in this project are used in a sociological way, serving as a tool to understand the culture of the city through the sounds that the different districts of the city produce. I then use politics, history, and other cultural bases to interpret and breakdown the sounds of the districts of the city, to then better understand the culture of Madrid. By the end of this project, I got a clearer understanding of each of the districts chosen from Madrid (each exemplifying a different aspect of the city) and through patterns, comparisons of findings, history, and the use of corroborating sources, I found three main tenets to the sonic understanding of Madrid's culture: The deep impact that climate change is having on the city's culture, the way that tourism is shaping the way the city operates, and how "social walking" acts as a basis for the city's culture. This project helps create an understanding of the culture of a historically important city, uniquely using sonic ethnography to do so.

Sonic Curation and Blues Aesthetics in American Plays

Trisha Santanam

Duke University
English
Research Faculty Mentor: Taylor Black, English, Duke University

Jeremy O. Harris's Slave Play (2018) interrogates how the legacy of slavery impacts race, sexuality, and labor for Black individuals in present-day America in a way that transgresses conventional literary form. Including pop-music, such as Rhianna's "Work," and The Universe's "Multi-Love," Slave Play extends the bounds of written language, transmitting information through both lyrics and also what can be intuitively felt and understood by way of musical attunement. Harris achieves this by invoking the concept of sonic curation, a method of arranging music that is informed by the afterlives of social, political, and geographical histories. Such musical refrains surround Slave Play, emerging from and engaging with concepts located within the blues tradition. Using Slave Play as a guide, I analyze how the idea of sonic curation is embedded in other American plays that reflect on Black lived experiences. Authors like Lorraine Hansberry, August Wilson, Adrienne Kennedy, and Suzan Lori-Parks include minstrel, jazz, modern-pop, and blues songs into their plays to make their writings transcend what can be understood by pure dialogue. These writers are indebted to traditional sonic curators—Ma Rainey, Big Mama Thornton, Nina Simone, Dinah Washington— who work within and beyond blues traditions. These singers know how to not only communicate knowledge through lyrics but also transmit the feeling of an experience through sound. The practice of sonic curation is one that is concerned not only with preservation but also re-membering. An audience viewing such plays is pushed to become "critically re-attuned" to feeling as a method of knowing.

Science in Nature	4:00 - 5:00 pm	Morris Inn, Hesburgh Room

Designing in Harmony with Nature, Synthesizing Two Sustainable Land Management Strategies: Agroforestry & BioGeometry

Enma Navarro
Virginia Polytechnic Institute and State University
Landscape Architecture
Research Faculty Mentor: Dr. John Munsell, Virginia Tech, Landscape Architecture, Virginia Tech, Benjamin C. Johnson, Professor Emeritus

Research Collaborators: Dr. John Munsell, Virginia Tech, Professor and Forest Management Specialist, Benjamin C. Johnson, Virginia Tech, Professor Emeritus, Mark Schonbeck, Organic Farming Research Foundation, Adam H. Taylor, Virginia Tech, Catawba Sustainability Center Manager; Mintai Kim, Virginia Tech, Landscape Architecture Professor

Abstract. The need for site design that is both sustainable and productive is increasing. Farmers are adopting both traditional and improved practices to generate greater income and better

yield. There are traditional and improved practices in agroforestry and bioGeometry, both land management systems that “work with nature”. At the Virginia Tech Catawba Sustainability Center (CSC) located in Catawba, Virginia, known as “a living laboratory for sustainable land management”, 56 acres out of 377 acres were selected to see what agroforestry practices and strategies can be employed for the environment, clean water, healthy soil, building soil, and regenerative practices. To minimize and offset the negative impacts of natural radiation of different types of energies emitted from earth, BioGeometry design principles were also applied at CSC. These practices and strategies balance the energy fields of the environment, have a positive impact on the overall health of the site and its regenerative practices. Here one reports two separate design projects on the same property with one project following agroforestry design parameters and the other employing BioGeometry principles. Agroforestry, like BioGeometry, is an ancient practice that only recently modern research has turned into a science. Moreover, we report that Agroforestry practices and BioGeometry can be used separately, but a functional inner linkage between the two can be established to improve land use management and strategies for sustainability and function.

Development of a Surface-Enhanced Raman Scattering (SERS) based Nanoprobe for Leaf pH Detection

Nicole Odibo
Virginia Polytechnic Institute and State University
Public Health
Research Faculty Mentor: Peter Vikesland, Civil and Environmental Engineering , Virginia Polytechnic Institute and State

Research Collaborators: Sonali Srivastava, Virginia Polytechnic Institute and State , Civil and Environmental Engineering; Delicia Gonsalves, Virginia Polytechnic Institute and State , Environmental and Water Resources Engineering

Accurately measuring pH outside of laboratory settings is a persistent challenge due to the lack of portable pH meters and the destructive nature of traditional measurement methods. Our research has sought to overcome these limitations by developing an innovative, efficient, and cost-effective method for pH measurement of both liquid and solid samples. Conventional methods for measuring the pH of solid materials often involve destructive processes such as soaking and grinding, which compromise the integrity of the sample. To circumvent this issue, we devised a non-destructive approach utilizing a nanoparticle-based pH probe and a spectroscopic technique called Surface Enhanced Raman Spectroscopy (SERS). In our method, gold nanoparticles are modified with a reporter molecule, resulting in distinct SERS peaks that correspond to different pH levels. Our method has potential for in-situ plant health monitoring as it is capable of measuring pH under various conditions since plant pH serves as a key indicator. To determine the pH of *leaves*, we applied a droplet of pH probe onto the leaf surface, and we subsequently captured SERS spectra. We measured the pH of leaves from five

distinct trees, both in their fresh and dried states and achieved accurate pH determination without sacrificing the sample or requiring elaborate equipment. The pH variations between these two states (fresh and dried) are significant. This non-destructive method enables pH measurements to be carried out in non-laboratory settings. Moreover, our method opens up new avenues for future research and real-world applications in the field of pH analysis.

Effects of minocycline and oxytocin on lipopolysaccharide-altered anxiety-like and social affiliative behaviors in prairie voles

Joelyz Wolcott
Florida State University
Behavioral Neuroscience
Research Faculty Mentor: Zuoxin Wang, Department of Psychology and Program in Neuroscience, Florida State University

Research Collaborators: Yan Liu, Florida State University, Department of Psychology and Program in Neuroscience

The socially monogamous prairie vole (Microtus ochrogaster) provides an excellent opportunity to study the impact of social environments on the brain and behavior. Recent data indicates that chronic social isolation increases anxiety-like behavior, decreases social affiliation, and elevates neuroinflammation in the brain of adult male prairie voles. We hypothesized that increased neuroinflammation in the brain may play a role in mediating altered behaviors associated with social isolation. In the present study, we injected male prairie voles with saline or lipopolysaccharide (LPS) – a cell wall component of gram-negative bacteria that induces neuroinflammation – and found that LPS treatment increased anxiety-like and decreased social affiliative behaviors. We then pretreated male voles with minocycline – an antibiotic with anti-inflammatory properties in the CNS – prior to LPS treatment. We found that minocycline reversed anxiety-like behaviors induced by LPS. Since LPS increased neuroinflammation in the nucleus accumbens (NAcc), minocycline decreased neuroinflammation, and NAcc oxytocin has been implicated in both anxiety-like and affiliative behaviors, we next examined the effects of intra-NAcc administration of minocycline or oxytocin on altered behaviors induced by LPS. Our data shows that LPS-induced anxiety-like behavior can be reversed by intra-NAcc administration of minocycline or oxytocin. However, only oxytocin, but not minocycline, was effective in rescuing social affiliation impaired by LPS. Together, these data indicate a brain region- and behavior-specific effect: a) neuroinflammation and oxytocin interact in the NAcc to mediate LPS-induced anxiety-like behavior; b) NAcc oxytocin can rescue LPS-impaired social affiliation; and c) additional brain areas/mechanisms might be involved in regulating neuroinflammation-impaired social affiliation.

-END-

Acknowledgements

We would like to thank the following offices and individuals for their support in hosting the 2024 Meeting of the Minds at the University of Notre Dame:

- The Flately Center for Undergradaute Scholarly Engagement, particularly
    - Jeffrey Thibert, Paul and Maureen Stefanick Faculty Director
    - Kati Schuler, Associate Director for Scholarly Development
    - Emily Hunt, Assistant Director for Scholarly Development
    - Elise Rudt, Associate Director for National Fellowships
    - Mathilda Nassar, Assistant Director for National Fellowships
- The Office of the Provost
- Notre Dame Research
- Dr. Erin Klawitter
- Dr. Jeffrey Rhoads