Three Minute Thesis Competition
University of South Carolina
November 7, 2025

COMPETITION SCHEDULE

PRELIMINARY ROUND

10:00-11:30 am **Heat A (Close-Hipp 534)**

- Sadegh Ahmadi, Mechanical Engineering
- Patrick Bailey, Mechanical Engineering
- Julia Cardarelli, Exercise Science
- Khushboo, Environmental Health Sciences
- Clara Kjerfve, Chemistry and Biochemistry
- Rume Kpadamrophe, Languages, Literatures, and Cultures
- Buddhima Maldeni, Chemistry and Biochemistry
- Ana Owusu, School Counselling
- Courtney Wright, Biomedical Sciences
- Jia Zheng, Drug Discovery and Biomedical Sciences

10:00-11:30 am **Heat B (Close-Hipp 535)**

- Alimi Abiodun, Chemistry and Biochemistry
- Oluranti Babalola, Social Work
- Courtney Carter, Chemistry and Biochemistry
- Yilian Du, Marketing
- Fakhreddin Emami, Mechanical Engineering
- Mohsen Gol Zardian, Mechanical Engineering
- Jordan Karrigan, Piano Pedagogy
- George Merhej, Drug Discovery and Biomedical Sciences
- Leslie Vann, Educational Practice and Innovation

10:00-11:30 am **Heat C (Close-Hipp 436)**

- Katheldra Alexander, Hospitality Management
- Debrup Chakraborty, Mechanical Engineering
- Garrett Evans, Exercise Science
- Mahtab Ghasemi Dogaheh, Drug Discovery and Biomedical Sciences
- Brian Harrold, Statistics
- Nima Kolmohammadi, Guitar Performance
- Amy Kortheuer, Educational Practice and Innovation
- Koryo Kwao, Chemistry and Biochemistry
- Ebenezer Seesi, Mechanical Engineering
- Grace Thaggard, Chemistry and Biochemistry

10:00-11:30 am **Heat D (Close-Hipp 450)**

- Anna Chupak, Health Promotion, Education, and Behavior
- Musbau Gbadamosi, Chemistry and Biochemistry
- Md Waliullah Hossain, Chemistry and Biochemistry
- Tempestt Johnson, Language and Literacy
- Mina Karami, Communication Sciences and Disorders
- Sabih Khan, Mechanical Engineering
- Yi Yi Li, Journalism
- Alireza Mashreghi, Civil and Environmental Engineering
- Emily Mathias, Philosophy
- Benedicta Nashiff, Pharmaceutical Sciences

10:00-11:30 am **Heat E (Close-Hipp 451)**

- Md Hasibul Amin, Computer Engineering
- Samin Ashjaei, Communication Sciences and Disorders
- Yarin Cohen, Social Work
- Devan Gavin-Von Roue, Media Arts
- M. M. Hosen, Chemistry
- Michael Kaven, Biomedical Engineering
- Price Lassahn-Worrell, Linguistics
- Timothy Philbeck, Biomedical Sciences
- Shahide Sayadian, Mechanical Engineering

FINALS

3:00-4:30 PM **Close-Hipp 750**

Judges

- **Dr. David Banush**, Dean of University Libraries
- **Dr. Stacy Fritz**, Associate Vice President for Student Health and Well-Being
- **Dr. Justin Lawhead**, Assistant Vice President for Career Readiness and Post Graduate Success

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HEAT A PRESENTERS

Sadegh Ahmadi
Title: Decoding a Dancing Drop: Uncovering Big Impact from Tiny Drop Vibrations
Abstract: A droplet may seem simple, but the moment it lands on a surface, it begins a hidden life of oscillation. It wobbles, vibrates, and slowly comes to rest, like a dancer finishing its final step. What drives this motion is the "contact line"—the tiny edge where the droplet, the surface, and the air all meet. Sometimes this edge is free to move, sometimes it sticks, and that difference changes everything about the droplet's rhythm and energy.
My research uses advanced computer simulations to reveal the secret rules behind this motion. I found that droplets have "critical points" where their behavior changes dramatically: they may lose energy quickly, cling stubbornly, or spread smoothly depending on how the contact line moves. These hidden dynamics determine how long a droplet keeps oscillating and how quickly it settles down.
Why does this matter? Because droplets are everywhere—in printing, coatings, medical devices, and even environmental processes. By uncovering the secret life of oscillating droplets, we can design smarter surfaces that print with precision, protect with longer-lasting coatings, and enable more reliable technologies. Tiny drops, it turns out, shape the world in big ways.

Patrick Bailey
Title: Cold Spray: A New Technique for Composite Repair?
Abstract: Cold Spray technology was first developed in the 1980's and is an additive manufacturing and repair technique. It works by heating pressurized gas to upwards of 600 °C and inserting metal particles downstream such that when they impact a substrate, the energy transformation causes plastic deformation of the particles. This thesis presents a use case for metal and polymer Cold Spray powder on fiber reinforced and fused filament fabrication polymer substrates. The state of the art for Cold Spray discusses the most up-to-date research within the field, and where new investigations are required. This research investigates what process parameters are required to bond metal and polymer powder to fiber reinforced polymer substrates, and how Cold Spray can be leveraged for composite repair. The Straight-Line, Powder Stack, and Bond Tests were performed on fiber reinforced polymers to characterize deposition of eight selected metal powders. These tests were performed inside a sandblasting cabinet with aluminum framing for sample support. Microscopy and conductivity analysis parameterization are conducted. The Straight-Line test was used to parameterize PEEK and PEI powders. Composite substrates were milled using a custom-designed 6-axis robotic manipulator to demonstrate a potential new repair technique for damaged composites using parameterization results. The composite repairs compressive strength is analyzed and compared to undamaged and scarf-repaired samples. Results show that Cold Spray can enable the Advanced Air Mobility market through its success in lightning strike protection

applications, and rapid substrate cosmetic repair, with potential improvements for structural repair.

Julia Cardarelli
Title: The Aging Brain: How Neural Connectivity Shapes Emotional and Social Satisfaction
Abstract: The brain is composed of approximately 86 billion neurons. It is a brilliant and powerful organ, often compared to a computer due to its incredible processing power and speed. Even after decades of research this complex organ's organization and function remain largely mysterious. Through advanced brain imaging techniques, we have learned that designated regions of the brain are responsible for specific actions, perceptions, and feelings. We also know that the brain uses tiny molecules called neurotransmitters to communicate between neurons. Using resting state functional magnetic resonance imaging, we can collect massive amounts of information about the connectivity between specific areas of the brain. This information is valuable for creating detailed representations of brain networks and the evolution of these networks during the process of aging.
My thesis aims to understand how the relationship of select brain regions and self-reported social and emotional beliefs change across the lifespan. The brain networks that I've selected to study are major dopamine pathways. The neurotransmitter dopamine is essential for various functions in the brain such as attention, memory, motivation, and emotion regulation. It also has implications for motor function in the body by regulating muscle movement and balance. We used National Institute of Health assessments to collect scores of positive and negative affect, and social satisfaction to represent emotional and social satisfaction. These findings may clarify how age-dependent changes in dopamine connectivity contribute to variations in emotional resilience and provide valuable insights for rehabilitation, neuroscience, and mental health research.

Khushboo
Title: Sunscreens Generate Persistent Free Radicals
Abstract: Mineral sunscreens (MSCs) containing titanium dioxide (TiO2) and zinc oxide (ZnO) are widely used for UV protection, but their photochemistry extends beyond short-lived reactive oxygen species (ROS). This study investigates the formation of persistent free radicals (PFRs) in commercial sunscreens under simulated sunlight to assess their potential risks to human health and aquatic environments. Electron spin resonance (ESR) spectroscopy revealed that all tested mineral and organic sunscreens (OSCs), generated long-lived radicals that persisted for days after irradiation. MSCs produced higher overall yields, with ZnO-only formulations showing elevated radical levels in water. X-ray photoelectron spectroscopy (XPS) confirmed surface hydroxylation of ZnO, which increases hydroxyl groups and promotes stronger phenolic binding. Among OSCs, phenolic UV filters such as oxybenzone produced stronger radical signals, while bulky substituents suppressed their formation. Estimated exposures suggest that a typical sunscreen application may generate ~10^17 PFRs, raising concerns about prolonged oxidative stress at the skin surface and in aquatic ecosystems. Unlike transient ROS, these PFRs are kinetically stable, redox-active, and capable of generating additional radicals even in the absence of light. By highlighting the role of

surface chemistry, molecular structure, and environmental conditions in radical persistence, this work highlights the need to reconsider sunscreen formulation strategies to mitigate long-term health and ecological risks.

Clara Kjerfve
Title: Immunotherapeutic Stimulation of Immune Activating Interferon Gamma
Abstract: The human immune system is composed of both innate and adaptive immune responses, which under normal conditions function synergistically to detect and eliminate infections as well as pathogenic mutations. However, mutations can enable diseased cells to evade immune surveillance by downregulating immune receptors or expressing inhibitory molecules, allowing them to persist undetected. In recent years, there has been growing research interest in harnessing and redirecting the immune system to achieve targeted and durable disease clearance—a significance reflected in the recent Nobel Prize recognizing advances in immunotherapy.
Cytokines, potent inflammatory signaling molecules, play a pivotal role in orchestrating immune activation at localized tissue sites. Among them, interferon-gamma (IFN-γ) is a key mediator that enhances receptor presentation and activates effector cells, thereby driving immune-mediated clearance of abnormal cells. Despite its therapeutic promise, current approaches that rely on systemic administration of IFN-γ are constrained by rapid clearance, poor tissue localization, and significant off-target toxicities associated with prolonged high-dose exposure.
To address these limitations, we propose a novel strategy to induce localized immune activation by delivering a protein that triggers intracellular pathways responsible for IFN-γ production directly within target cells. Our preliminary findings demonstrate that this protein can activate immune signaling cascades at low doses. Ongoing work is focused on optimizing delivery mechanisms to achieve efficient intracellular uptake and controlled activation. By enabling localized IFN-γ expression, this platform aims to enhance immune-mediated tumor clearance while minimizing systemic toxicity. Ultimately, this approach has the potential to provide a more precise and effective immunotherapeutic strategy.

Rume Kpadamrophe
Title: Where the Dead Still Speak: The Novel as a Living Monument
Abstract: My presentation examines how the novel functions as a tool for preserving collective memory and sustaining the presence of the past within what John Mbiti calls the realm of Sasa—the living present. Every culture finds ways to live with its dead, whether through monuments, cemeteries, or rituals. Similarly, the novel serves as a literary monument, allowing us to coexist with the specters of the past. I argue that novels engaging with historical and traumatic events act as portable monuments: they give voice and life to the ghosts of history, enabling them to speak to us in the present. The works I analyze revisit moments of collective trauma—the Holocaust, the Rwandan genocide, the Murambatsvina massacres in Zimbabwe, and the Nigerian Civil War. Across these texts, the return of the past signifies not merely remembrance but an ethical demand for justice and renewal. These narratives remind us that the past is never fully past; it haunts the present until it is acknowledged and reimagined. Ultimately, I contend that the novel animates memory by keeping these specters within the realm of Sasa. In doing so, it

transforms trauma into a living presence that continues to shape our moral and cultural consciousness—reminding us that to forget is to risk repetition.

Buddhima Maldeni
Title: Mapping Catalyst Distribution in Porous "Sponges" through Energy Transfer
Abstract: Contributing to processes worth nearly $10 trillion annually, solid-supported (heterogeneous) catalysts are vital to building a greener future, offering efficiency, recyclability, and resilience that support a sustainable chemical industry. One strategy to obtain highly efficient and competitive heterogeneous catalysts is to incorporate reactive and efficient molecular catalysts into solid porous "sponges." A promising candidate for such porous "sponges" is metal-organic frameworks (MOFs), which are constructed from metal nodes and organic linkers to form extended porous platforms. MOFs have gained significant attention for their modularity, tunable pore sizes, and versatile methods of catalyst incorporation. However, there is an urgent need to understand catalyst distribution within these "sponges", as it reveals how accessible the catalysts are to reactants, directly influencing catalytic performance and thereby establishing a foundation for the rational design of more efficient solid-supported catalysts. Therefore, this study introduces a fluorescence spectroscopy-based catalyst mapping method, Förster resonance energy transfer (FRET), to investigate catalyst positioning at the Angstrom-scale in porous "sponges" with different pore topologies, as well as the impact of catalyst migration after exposure to industrially relevant reactions. This fundamental understanding of catalyst distribution provides a rational foundation for designing next-generation porous materials with embedded catalysts that exhibit enhanced activity, durability, and sustainability.

Ana Owusu
Title: Rethinking Adolescent Counselling: How CBT Meets Culture and Context
Abstract: Cognitive Behavioral Therapy (CBT) is one of the most widely used and effective approaches for addressing depression, anxiety, and trauma in adolescents. Its focus on reshaping unhelpful thought patterns and building healthier coping strategies has transformed countless lives. Yet in schools, CBT is often applied in ways that overlook the cultural and environmental realities shaping a student's experiences. My research examines how CBT can be adapted to reflect the diverse identities of adolescents while still preserving its evidence-based strengths. Through analysis of case studies and counseling practice, I investigate how counselor identity and cultural responsiveness influence the effectiveness of CBT. For example, a student experiencing test anxiety may not only struggle with negative thought patterns, but also with broader systemic issues such as bias or limited access to support. By situating CBT within these lived contexts, counselors can empower students to challenge unhelpful beliefs while also affirming their identities. This work contributes to counselor education by bridging the gap between a trusted therapeutic model and the need for equity-driven practices in schools. Ultimately, my thesis highlights how CBT can remain a gold-standard approach while evolving into a tool that honors the whole child. By refining our methods, school counselors can ensure that every student receives not only evidence-based care, but also culturally relevant and identity-safe support.

Courtney Wright
Title: Kynurenic Acid, Sleep, and Inflammation During Pregnancy Are Important Therapeutic Targets for Mental Health
Abstract: Maternal inflammation, from infections or prolonged sleep disturbances, during pregnancy is a highly recognized risk factor for compromised offspring neurodevelopment and psychiatric illness. Infections and sleep disruptions elevate tryptophan degradation via the kynurenine pathway and increase kynurenic acid (KYNA) levels, an inhibitor of glutamatergic and cholinergic neurotransmission, both critical to neurodevelopment. KYNA is elevated centrally in adults with psychiatric disorders (schizophrenia, bipolar disorder). Thus, we hypothesize that prenatally elevated KYNA is a mechanistic link between disturbed maternal sleep, inflammation, and poor offspring health.
Wistar rats were manipulated the last week of pregnancy (embryonic day 15-21). Experiment 1: Chronic sleep fragmentation occurred via a novel paradigm that disrupted maternal sleep 18hrs/day (N=4-6). Experiment 2: Maternal diet was supplemented with kynurenine (100 mg/day), direct KYNA bioprecursor, to elevate kynurenine metabolism only (N=6-7). On embryonic day 21, we assessed maternal sleep, maternal plasma cytokines, and metabolites (kynurenine, KYNA) in maternal (plasma, brain) and fetal (placenta, brain) samples.
Sleep fragmentation reduced sleep ($P<0.0001$) and significantly elevated plasma cytokines like IL-1□ ($P<0.01$), a kynurenine metabolism activator. Sleep fragmentation did not alter maternal metabolites, yet elevated fetal brain KYNA ($P<0.05$). Kynurenine diet impaired sleep quality (-10% sleep duration, $P<0.05$), yet plasma cytokines were unaffected. Kynurenine diet elevated KYNA systemically (maternal brain: $P<0.01$; fetal brain: $P<0.0001$). Kynurenine pathway activation was more pronounced in male versus female fetal brain across experimental paradigms. Our models identify elevated fetal KYNA as a molecular consequence of inflammation and sleep disturbances translationally relevant for psychiatric illness and sex-specific neurobiological outcomes.

Jia Zheng
Title: Building with Blocks to Erase Cancer Proteins
Abstract: Many cancers are driven by harmful proteins that have long been considered "undruggable." For decades, our main strategy was to block these proteins, but what if we could completely erase them instead? This is the exciting promise of new medicines called protein degraders, which cleverly hijack the cell's own garbage disposal system to eliminate these harmful targets.
Our research use a novel "building block" method to create these potential drugs. This modular approach allows us to easily design drugs from scratch, much like putting LEGOs together. Excitingly, one of our first molecules shows powerful anti-cancer activity in the lab. But another key question remains: how exactly does it work?
To investigate this, we turn to the power of AI. We use state-of-the-art AI-predicted protein structures to build 3D simulations. This modeling allows us to visualize at how our molecule might be behaving with proteins. This helps us understand its potential and guides our future experiments. This combined strategy of modular

chemistry and computational analysis creates a powerful platform to accelerate the discovery of next-generation cancer therapies.

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HEAT B PRESENTERS

Alimi Abiodun
Title: Designing Smarter Antibiotics: How Polymer Structure Influences Biological Activity
Abstract: Antibiotic resistance is one of the greatest threats to global health, yet many of our current drugs are losing their power. Nature has already designed molecules—called antimicrobial peptides—that can kill bacteria effectively, but they are unstable and expensive to use as medicines.
My research focuses on designing synthetic mimics of these peptides, known as SMAMPs, which aim to capture their bacteria-fighting power while overcoming those limitations. I study how the arrangement of building blocks within these synthetic molecules—their monomer distribution—influences how well they kill bacteria and how safely they interact with human cells.
By comparing polymers with the same overall composition but different internal arrangements, I found that even small changes in structure can dramatically alter whether they attack bacteria or harm human cells. In other words, structure matters—not just what ingredients we use, but how we arrange them. This work reveals how molecular architecture shapes biological activity and provides design principles for creating safer, more effective synthetic antibiotics. Ultimately, these insights could help develop new materials to combat antibiotic-resistant infections and protect global health.

Oluranti Babalola
Title: Advance Care Planning During Crisis: Trends in Older Adults with Dementia Post Covid19
Abstract: Advance care planning (ACP) is critical for older adults with Alzheimer's disease and related dementias (ADRD) to ensure care preferences are honored as cognition declines. Despite its importance, ACP engagement remains suboptimal, influenced by disparities in healthcare access, cultural norms, and systemic barriers. The COVID-19 pandemic disrupted healthcare delivery and heightened awareness of end-of-life (EOL) planning, yet its impact on ACP among older Americans with ADRD is unclear.
Objective: To examine ACP engagement trends before, during, and after COVID-19, and identify factors associated with engagement in older adults with ADRD.
Methods: We analyzed data from 1,854 respondents with ADRD in the Health and Retirement Study (HRS) across three periods: pre-COVID (2014–2018), COVID (2020), and post-COVID (2022). ACP engagement was measured by discussions, documented living wills, care-limiting clauses, and durable power of attorney (DPOA) assignment. Weighted proportions and multivariable regressions assessed temporal trends and sociodemographic associations.
Results: Most respondents were aged 75–89 (42.9%), female (58.2%), and non-Hispanic White (77.5%); 90% were Medicare-insured. ACP discussions rose significantly from 54.2% pre-COVID to 67.9% post-COVID (p for trend = 0.05). No

significant changes were observed in living wills (68.3% to 63.7%, p = 0.57), DPOA assignment (79.5% to 74.3%, p = 0.80), or care-limiting clauses (92.3% to 89.9%, p = 0.60). Engagement was higher among college-educated individuals (OR: 2.49; 95% CI: 1.41–4.41) and those without severe functional limitations, while being Black (OR: 0.49; 95% CI: 0.28–0.87) and Medicare-insured (OR: 0.18; 95% CI: 0.05–0.64) predicted lower engagement.
Conclusion: COVID-19 was linked to increased ACP discussions among older adults with ADRD, but persistent disparities and limited formal documentation underscore the need for targeted, culturally sensitive interventions to transform discussions into actionable EOL care plans.

Courtney Carter
Title: Electrochemical Sensor for Stress Biomarker Monitoring
Abstract: The continual monitoring of critical stress biomarkers is essential for the diagnosis and treatment of stress-related conditions. Electrochemical methods offer sensitive, selective, rapid, cost-effective, and long-term measurement of such biomarkers. This presentation highlights our recent advancements and future objectives in developing an electrochemical biosensing platform for continuous monitoring of cortisol as a stress biomarker. Our design employs structure-switching nucleic acids, or aptamers, as biorecognition elements to selectively bind to cortisol. While current electrochemical aptamer-based biosensors (E-ABs) show promise, traditional designs that rely on large, planar gold electrodes face challenges in stability and reproducibility due to poor aptamer surface coverage. To overcome these challenges, we present a novel E-AB design using aptamer-gold nanostructure-modified carbon ultramicroelectrode arrays (Apt-AuNS-CUAs). CUAs contain approximately three billion carbon-based ultramicroelectrodes (~90 nm radius) per square cm, arranged in an array and surrounded by a metal oxide layer. These unique CUA features result in high signal-to-noise ratios, rapid sensor response times, and reduced electrode adsorption. Recent progress has demonstrated the successful electrodeposition of gold nanostructures (AuNPs) onto CUAs via our novel alternating potential pulse (APP) method, enabling aptamer immobilization. Optimization of APP electrodeposition parameters—such as deposition potential, time, and gold ion concentration—has achieved effective AuNS functionalization with large electroactive surface area and improved electrode coverage. Subsequent immobilization of cortisol-specific aptamers on the AuNS-CUA platform has enabled the detection of biologically relevant, nanomolar (nM) concentrations of cortisol. Future studies will further evaluate the analytical performance of this AuNS-CUA E-AB platform for continuous cortisol monitoring in biological fluids.

Yilian Du
Title: Reselling Surcharges in Online Grocery Marketplace
Abstract: This study explores whether and to what extent reselling drives price inflation in online retailing platforms. Resellers independently select and purchase products from manufacturers and authorized distributors, earning profits by marking up and offering the items at online marketplaces. To examine the extent to which reselling affects product prices, we collect data on offerings across multiple grocery departments from a major online platform. We find that, for grocery products,

average prices are higher than manufacturer prices and than prices at local brick-and-mortar stores. We use NielsenIQ data to investigate whether such dispersion affects prices paid by consumers and find that a significant proportion of consumers pay more online than offline. The results offer a deeper understanding of how reselling behavior affects consumer behaviors and identifies key drivers of inflationary effects in online retail marketplaces.

Fakhreddin Emami
Title: Buoyant Bones for Harsh Worlds
Abstract: Imagine standing on Venus, a planet so hostile that it crushes, burns, and corrodes almost anything we send there. Its surface is hot enough to melt lead, its atmosphere dense enough to crush submarines, and its clouds thick with acid. Surviving there seems impossible — unless we rethink how we build materials.
My research develops multifunctional ceramic truss lattices: ultra-lightweight structures with the strength of bone, the resilience of scaffolds, and the ability to float like ships. By carefully designing their geometry, these architected ceramics break free of the traditional trade-off between weight and strength. Instead of getting weaker as they get lighter, they become both stronger and more adaptable.
Even more exciting, these lattices act as natural thermal insulators, slowing heat transfer. That means they could shield delicate equipment — or even habitats — against Venus's extreme heat while still staying light enough to float.
Beyond Venus, these ceramics could transform how we design aircraft, spacecraft, and infrastructure here on Earth — offering durability, insulation, and buoyancy without excess weight. From harsh worlds to everyday applications, my work shows how engineering materials at the lattice scale can help us imagine structures that don't just survive, but thrive, in the most extreme environments.

Mohsen Gol Zardian
Title: What a Doughnut Can Teach Us About Flood Protection
Abstract: Flooding is one of the most destructive natural disasters globally, often resulting from the sudden failure of levees and earthen embankments. Identifying early signs of structural weaknesses, like minor dips, internal gaps, or surface distortions. Exploring anomalies is difficult because conventional monitoring methods typically detect visible changes only after serious damage has occurred. My research tackles this issue by integrating high-resolution LiDAR data with Topological Data Analysis (TDA), a mathematical technique that examines the fundamental connectivity of shapes rather than their exact geometry. For example, topology equates a coffee cup and a doughnut because each has a single hole. Similarly, TDA uncovers hidden structural traits by spotting loops, voids, and cavities within the levee surface. These topological markers can serve as early warnings for erosion and structural instability long before a failure happens. By applying this approach to actual levee point-cloud data, I aim to build a predictive model for assessing flood risk. This method turns abstract mathematics into a tangible solution for safeguarding communities, allowing engineers and decision-makers to identify weak spots sooner, optimise maintenance, and potentially save lives.

Jordan Karrigan
Title: “Unchoking” Under Pressure: Using Self-Talk Across Performance-Based Disciplines
Abstract: The ability to manage anxiety under pressure is a persistent challenge but an essential skill across disciplines such as music, athletics, education, medicine, and other performance-based professions. Throughout history, performers and other professions have sought to overcome this through self-devised coping mechanisms through superstition or informal self-help advice, yet few approaches have produced strategies that are empirically validated and adaptable for instructional use.
Research in sport psychology identifies the phenomenon of “choking under pressure,” in which well-learned skills deteriorate under the effects of mismanaged anxiety and demonstrates that this can be mitigated through targeted intervention techniques. As success in many modern careers depends on the ability to perform effectively under evaluative pressure, it is imperative that individuals in performance-based fields have access to strategies that are both practical and feasible to implement.
Despite increased awareness of performance anxiety, training in anxiety management remains largely absent from professional curricula. Developing professionals often seek guidance from their instructors, yet many teachers rely on coping methods that, while effective for experts, are rarely transferable to novices. As a result, developing their skills are left without reliable, research-informed frameworks for managing anxiety in high-stakes performance contexts.
This presentation examines a pilot study evaluating Instructional Self-Talk, a sport psychology intervention using brief verbal cues to improve performance. Conducted in a collegiate group piano course, it tests this approach in an early evaluative setting where students perform new skills outside their primary discipline. This research demonstrates how sport psychology interventions can inform pedagogy across performance-based disciplines.

George Merhej
Title: Finding the Right Target – Developing Smarter, Safer Cancer Drugs
Abstract: Polo-Like Kinase 1 (PLK1) is elevated in prostate cancer and is linked to higher tumor grade. Elevated PLK1 is critical to adapt to mitotic stress caused by deletion of a tumor suppressor gene called Pten. This suggests that PLK1 is a promising drug target for prostate cancer patients harboring Pten deletions(Liu et al., 2012). PLK1 has 2 main domains: a highly conserved N- terminal catalytic Kinase Domain (KD), and a less conserved, functionally essential C-terminal Polo Box Domain (PBD), separated by a interdomain linker (Strebhardt & Ullrich, 2006). In the McInnes/Wyatt labs, novel nonpeptidic PBD- binding drugs have been developed, namely Abbapolins (ABBAs). Abbapolins were shown to demonstrate potent antiproliferative activity in prostate and other cancer cell lines, to inhibit PLK1 activity, and to induce PLK1 degradation (Chapagai et al., 2021). Among the several abbapolins that were developed, two were selected to be tested in an animal xenograft model of prostate cancer, based on potent antiproliferative activity in cellular assays and in the NCI-60 tumor panel. Both abbapolins showed significant in vivo anti-tumor activity depicted by reduced tumor volume in treated relative to untreated mice, and decreased PLK1 expression. Related to their anti-cancer activity, abbapolins have been shown to promote conformational changes in PLK1

that are different than those induced by their KD inhibitor counterparts. We have shown that Abbapolins produce ligand induced thermal stabilization of PLK1, while KD inhibitors produce a less thermally stable protein (Chapagai et al., 2023). Current work is focused on understanding the cellular implications of the different conformations and their effects on PLK1 dimerization. Better understanding of PLK1 conformational dynamics will enhance our knowledge of PLK1 functions in normal and in cancer settings and of PLK1 interaction with other proteins. Moreover, recent data from the NCI-60 panel shows sensitivity of other cancer cell lines to our PLK1 inhibitors and currently, abbapolins are also being tested against some of these. In conclusion, our work investigates novel PLK1 inhibitors in prostate cancer and aims at using those inhibitors as probes for understanding conformational dynamics of PLK1 in cancer and in normal settings.

Leslie Vann
Title: Breaking the Cycle: Equity and Understanding in Special Education for Black Male Students
Abstract: Across schools nationwide, Black male students are disproportionately identified for Special Education services, particularly in categories such as Emotional Disturbance and Behavior Disorder. As both a Black male and a Special Education teacher, I have witnessed how implicit bias, trauma, and teacher perception contribute to this inequity. My research explores the underlying factors that lead to the overrepresentation of Black male students in Special Education at Irmo High School and investigates how culturally responsive, trauma-informed practices can promote fairer identification and stronger academic and behavioral outcomes. Using action research, I aim to bridge the gap between intention and impact by helping educators recognize bias, reframe behaviors, and implement interventions that affirm and support students. Ultimately, this study seeks to change how we see and serve Black boys in our schools, moving from labeling to truly understanding who they are.

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HEAT C PRESENTERS

Katheldra Alexander
Title: Ready to Leap? The Impact of Social Anxiety of Emerging Hospitality Management Leaders
Abstract: Students are grappling with raised social anxiety in recent years. In the first phase of the three-part study, the authors showed significant findings of self-reported student anxiety and its negative effects on their work readiness. Increased social anxiety is detrimental to the hospitality industry. The hospitality and tourism industry despite the increased use of technology, remains centered around an intangible product – the experience of the guest. As the host- today's student, the future hospitality leader must be ready to assert themselves and take care of the guest, train staff and manage conflict.
Therefore, if hospitality staff interaction with guests is integral to complete the sale of the hospitality experience, how to handle social aspects of service interactions are crucial skills for all future managers to learn. A manager should exemplify these core beliefs and be capable of training other staff to do the same. Considering the average student's college experience, are the rising levels of social anxiety being addressed?
Based on the cognitive theory of social anxiety and the analysis planned, the goal of the study is to answer the following question. What is the effect of levels of anxiety on students' capability to lead in their newly acquired managerial roles? The current study addresses an empirical gap with a focus on the hospitality undergraduate student population and work readiness. The current three-part study has an expansive viewpoint by addressing multiple stakeholders of the work readiness question. Implications include a review of the current educational model and student employability post-graduation.

Debrup Chakraborty
Title: Milliseconds that Matter: Tackiness and Defect Prevention in Automated Tow Placement Fabrication of Composite Aircraft Fuselages
Abstract: Modern aircraft rely on lightweight composite materials that make them stronger, more fuel-efficient, and more sustainable. But building these large composite fuselages is far from simple. Even tiny defects like wrinkles or gaps between layers can weaken the structure and lead to costly repairs or safety concerns. My research focuses on one of the hidden causes of these defects: tackiness, or how sticky the composite layers are when they first touch under heat and pressure. This stickiness determines how well each layer bonds to the next during automated manufacturing, known as automated tow/fiber placement (ATP/AFP). To study tackiness, a novel high-speed experiment is developed that captures what happens in just a few thousandths of a second, the same timescale used by ATP robots that lay down the material. By carefully controlling temperature, pressure, and contact time, I measure how the bond forms and how strong it becomes. These results feed directly into advanced computer models that simulate

the manufacturing process in real time. Understanding tackiness at these fleeting timescales helps engineers predict when and where weak bonds might occur and how to prevent them before defects form. This means fewer inspections, faster production, and stronger, safer aircraft. In short, by studying what happens in mere milliseconds, we can make major improvements in how aircraft are built, proving that sometimes, the smallest moments make the biggest difference.

Mahtab Ghasemi Dogaheh
Title: Synthesis of peptides as cyclin F inhibitors: A new approach to cancer treatment
Abstract: Cyclin F, a key cell cycle regulator, mediates the ubiquitination of numerous target proteins through E3 ubiquitin ligase complex (SCF), leading to their degradation by proteasome. These substrates, including RRM2, CP110, NUSAP, Cdh1, CDC6, B-Myb, E2F1-8, RB, P130 and P107 (called RBL proteins), EXO1 and SLBP are targeted by Cyclin F for ubiquitination and degradation, contributing to cell cycle progression, DNA replication and repair and maintaining genome stability.
The degradation of these substrates through Ubiquitination-Proteasome System (UPS) plays a significant role in pathology of several human malignancies, including breast cancer, hepatocellular cancer, lung cancer, renal cell carcinoma, Familial Hodgkin Lymphoma and pancreatic cancer. Therefore, Cyclin F may function as a prognostic biomarker and a promising therapeutic target in cancer.
Retinoblastoma protein (RB) is a prototypical tumor suppressor. This protein and its paralogs (p107 and p130) are critical negative regulators of the cell cycle, primarily by associating with E2F family members to repress gene expression related to cell proliferation, apoptosis, and differentiation keeping them inactive, thereby preventing unscheduled cell cycle entry 9.
Based on the interaction between Cyclin F and P130 and the role of cyclin F in degradation of P130, our hypothesis is that by understanding these interactions and identifying their binding sites, we can design and synthesize peptides which binds to Cyclin F and through inhibiting
Cyclin F, they can prevent its interaction with the substrates. Thereby, preventing substrates degradation would enhance their tumor-suppressing effects in cancer.

Garrett Evans
Title: Whole Body Vibrations Effects on Joint Kinematics, Kinetics and Muscular Activation
Abstract: What if standing on a vibrating platform could enhance athletic performance? Previous studies suggest whole-body vibration (WBV) could enhance athletic performance, such as sprinting faster and jumping higher. While WBV is thought to increase muscle activations by facilitating proprioceptive feedback, no studies have examined its concurrent effects on athletic performance, muscle activations, force production, neuromechanics, and joint movement. Accordingly, the influence of WBV on athletic performance remains unclear.
My research aims to investigate how WBV enhances athletic performance by examining the effects of three WBV protocols on countermovement and squat jumps, two standard assessments of athletic performance. Twenty-four healthy, recreationally active males (n=12) and females (n=12) from 18-25 will be recruited for a crossover trial involving a familiarization session and two testing sessions on

separate days. In each testing session, participants will complete either three countermovement or squat jumps (random order) before and after each of WBV protocol: 5x0s (control-no vibration), 5x30s, and 5x60s of WBV (random order). The effects of WBV on athletic performance, muscle activation, neuromechanics, force production, and joint movement will be quantified by measuring: (1) maximum jump height, (2) peak muscle activation, (3) reactive strength index, (4) peak vertical force, and (5) joint angular velocity.
The results of this research will improve our mechanistic understanding of how WBV enhances athletic performance. This knowledge will improve our ability to optimize training protocols for athletes and facilitate the development of targeted rehabilitation strategies for clinical populations.

Brian Harrold
Title: The Hidden Map Inside Your Test: Revealing Connections Among Questions, Skills, and Students
Abstract: Tests record right and wrong answers to gauge what students know. However, questions can share hidden features, such as a common passage or an extra skill, that link them together. These invisible connections can blur inferences about students' knowledge. This research combines two ideas into a new model to make those links visible. First, a diagnostic model estimates which skills students have likely mastered. Second, an interaction map places students and questions in the same geometric space after accounting for those skills. When the diagnostic model explains the data, the map looks like scattered noise. When it does not, meaningful clusters and patterns appear. Questions that share dependencies tend to group together, while questions that require an overlooked skill will be pushed further away. Groups of students align with particular item clusters, pointing to shared strengths or barriers. The map becomes an illustration of what the diagnostic model does not capture. It can flag question sets that are related for unintended reasons, show where a requisite skill has been overlooked, and highlight student groups who would benefit from targeted support. It turns student responses to test questions about measured skills into a picture that educators and test designers can read to find the hidden treasures that they may have missed. By revealing the structure behind scores, this work helps build better tests, so that those hidden patterns can be easy to see.

Nima Kolmohammadi
Title: The Art of Teaching Guitar - Why Most Guitar Methods Fail - and How We can Fix Them
Abstract: The guitar is one of the most popular instruments in the world, attracting learners of all ages. Yet, more than 90% of beginners quit before reaching even an intermediate level. The problem is not a lack of passion or discipline—but the way we teach. Most classical guitar methods, including those by Aaron Shearer, Christopher Parkening, and even the Suzuki Method, follow a path that appears logical on paper but fails in practice.
I believe in a different approach—one that can significantly increase the number of students who continue playing guitar for years. A more accessible and gradual method will bring a larger community around the instrument—more students, more income for music schools, more musicians, and ultimately more songs in the world.

A well-designed and realistic method book has the power to transform not only classical guitar education but also every genre that includes the guitar.

Amy Kortheuer
Title: Civil Discourse: Unity Through Plurality
Abstract: American society has become increasingly polarized. Our perception of this growing divide has created a snowball effect: emotional polarization feeding ideological polarization, and vice versa. Our social fabric is fraying, and the kids aren't alright. Schools, as microcosms of society, are showing tears in all the same places. Students are scared to speak up and losing not only their voice, but also their opportunity to understand the complexity of the world around them. It is time to act—through the deliberate practice of civil discourse in our classrooms.
Civil discourse goes beyond mere politeness. It invites participants to engage earnestly with ideas, to listen attentively, and to seek understanding of the "why" behind differing perspectives. Rather than erasing our differences, civil discourse humanizes them, offering a path toward healing the fractures that define our society and politics today.
If we can help students develop the habit of listening before judging—and of allowing others the space to grow rather than dismissing them outright—they can carry those habits into the wider world. My research explores how civil discourse in schools can be leveraged to rebuild unity through plurality and reinforce democracy by teaching disagreement without dehumanization.

Koryo Kwao
Title: When Small Changes Make a Big Difference: Fold-Switching Proteins for Expanding the Folding Code
Abstract: Proteins play key roles in several biological processes, including digestion, immunity, and hormonal regulation. Protein structure and biological activity are dependent on the amino acid building blocks present in the sequence. To understand how amino acid composition affects protein function, my research focuses on homologous synthetic proteins, which are proteins with subtle sequence changes made outside the cell. The goal of this project is to correlate sequence changes with known intra- and intermolecular interactions, which drive protein function. Synthetic protein homologs are prepared using an automated instrument built in our laboratory. Further studies reveal the critical interactions that drive the conformation and activity of proteins and relate them to the protein sequence. The findings of these studies will inform the development of protein-structure-prediction tools and next-generation therapeutics.

Ebenezer Seesi
Title: Tiny Oxygen Gaps, Big Power: Turning Waste Heat into Electricity
Abstract: Every day, engines, factories, and power plants release vast amounts of waste heat into the air. Our goal is to capture that heat and quietly convert it into electricity. Thermoelectric generators can do this, but the best existing materials rely on rare or toxic elements, which are unsuitable for large-scale use. We develop a safer, low-cost ceramic called calcium manganese oxide, formed into ultra-thin layers that are thousands of times thinner than human hair. Thin films are ideal for discovering design rules because they allow atomic-scale control and reveal

immediate electrical changes, which are harder to observe in bulk materials. Insights from these films can then guide coatings or bulk ceramics for manufacturing.
When oxide films grow, they stretch, which creates tiny missing oxygen atoms. A few of these tiny gaps help electricity flow, but too many act like potholes that slow it down. Since they cannot be avoided, our goal is to find the right balance. Our experiments show that less stretching yields better performance: relaxed films retain enough missing oxygen atoms to carry charge without damaging the crystal, producing a much stronger electrical response. In fact, relaxed films outperform highly stretched ones by orders of magnitude in key electrical measures.
This gives us a clear path forward: use thin films to tune and optimize these tiny gaps, then carry those winning conditions to scalable coatings or bulk ceramics. The result is a practical route to abundant, non-toxic ceramics capable of converting industrial waste heat into clean, reliable electricity.

Grace Thaggard
Title: Designing a "Synthetic Leaf" through Photochromic Metal-Organic Frameworks
Abstract: As global demands for more sustainable energy sources continues to grow, research and development of synthetic light-harvesting materials for organic photovoltaics (OPVs) and photocatalysts has become a dominant field of research. Despite recent impressive improvements in solar cell efficiency, current state-of-the-art OPVs have only reached ~20% energy transfer (ET) efficiency. In contrast, the natural photosystem, which harvests sunlight to provide energy for plants, relies on the precise arrangement of hundreds of chromophores participating in directional ET pathways in a single leaf to achieve nearly 100% efficiency. Inspired by the highly effective hierarchical arrangement of chromophores in the natural photosystem, this presentation explores how metal-organic frameworks (MOFs), which are crystalline structures composed of inorganic metal nodes connected by organic linkers, can be used as a scaffold to achieve precise organization of light-harvesting molecules resulting in a "synthetic leaf". In particular, photochromic molecules, which undergo isomerization between two distinct forms upon exposure to appropriate excitation wavelengths, can not only harvest light, but also direct ET processes based on their photoisomerization. As a result, photochromic MOFs can harvest light and then funnel energy in pre-designed pathways, thereby mimicking the natural photosystem. Moreover, integrated photochromic moieties behave as "switches" which can be used to tailor ET efficiency using light as a non-invasive external stimulus. Thus, integration of photochromic compounds in well-defined structures creates a "synthetic leaf" that is composed of hierarchically organized chromophores cooperating to harvest, store, and transfer solar energy.

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HEAT D PRESENTERS

Anna Chupak
Title: When Mind Meets Medicine: How Cognitive Decline is Associated with Preventive Health in Midlife and Old Adults
Abstract: Subjective cognitive decline (SCD), self-reported difficulties with memory and thinking, may delay healthcare engagement, hindering adoption of preventive behaviors. Using 2022-2023 CDC Behavioral Risk Factor Surveillance System survey data, we analyzed the relationship between SCD (including SCD-related characteristics) and adherence to six preventive healthcare behaviors among U.S. adults aged ≥45 (n=200,584): flu shot, routine check-up, dentist visit, colorectal screen, mammogram, and prostate-specific antigen test. Logistic regressions controlled for several individual health and sociodemographic covariates, clustering by state/territory. SCD was associated with higher odds of having a flu shot, routine check-up, and colorectal screen, but lower odds of having a dentist visit. Poor healthcare access was associated with lower adherence to all six healthcare behaviors regardless of SCD. Discussing SCD with a provider increased odds of adhering to all preventive healthcare behaviors, except dentist visit. Maintaining healthcare access and provider relationships may promote better adherence to preventive behaviors among adults with SCD.

Musbau Gbadamosi
Title: Energy and Environment: The role of hydrogen
Abstract: With various environmental concerns that have arisen due to pollution caused by the use of fossil fuel as a source of energy, hydrogen fuel has emerged as an alternative. Hydrogen has an advantage as an alternative source of energy due to its cleanliness, abundance, and high gravimetric energy storage density. The transportation and storage of hydrogen have been a challenge to the adoption of hydrogen as an alternative, efficient, and sustainable energy solution to fossil fuel. The dehydrogenation of methylcyclohexane (MCH) to toluene using liquid organic hydrogen carriers (LOHCs) is a promising approach to solving this challenge due to its wide use for industrial applications, low toxicity, and liquid state at ambient temperature. My research is based on designing a suitable catalyst for the dehydrogenation MCH for hydrogen production.

Md Waliullah Hossain
Title: Synthetic Polymer as antimicrobial agent against multi-drug resistant (MDR) bacteria
Abstract: The rapid emergence of multi-drug resistant (MDR) Gram-negative bacteria, alongside the significant reduction in novel antibiotic development, has created a pressing demand for novel therapeutic alternatives. Cationic metallopolymers have garnered considerable attention due to their strong antimicrobial potential. In this work, we synthesized a series of broad-spectrum antimicrobial copolymers incorporating cationic cobaltocenium and ammonium units

with varied compositions, achieving an optimal amphiphilic balance to facilitate enhanced interactions with negatively charged bacterial membranes. These copolymers exhibited pronounced antimicrobial activity with improved selectivity relative to primary ammonium-based methacrylate analogues. Mechanistic studies were conducted with a focus on bacterial strains expressing the New Delhi metallo-β-lactamase (NDM-1) enzyme, these investigations confirmed its membrane-disruptive mode of action. Most importantly, the lead polymer was able to suppress the bacterial resistance compared to the antibiotic throughout the test time span. Altogether, these findings underscore the potential of metallopolymers with finely tuned amphiphilicity as promising antimicrobial candidates against Gram-negative bacteria.

Tempestt Johnson
Title: Let Them Dance: A Qualitative Study Examining the Literacies of Black Girls in Dance
Abstract: This qualitative study examines the lived experiences of Black girls in high school majorette dance teams, exploring dance as an embodied literacy practice and site of resistance. Grounded in the recognition that Black girlhood is systematically stolen through adultification bias (Epstein et al., 2017) and hypersexualization (Curtis et al., 2022), which constrain Black girls' embodied expression, this research investigates whether majorette dance spaces under Black women's guidance function as protective environments where Black girls can express themselves freely. The study is guided by five research questions exploring dancers' lived experiences, their descriptions of dance spaces, perceptions of dance as resistance (Snowber, 2016), majorette dance as critical storytelling, and embodied literacy practices through dance.
The conceptual framework, Black Girls' Dance Literacies, integrates Critical Race Theory's counter-storytelling tenet (Delgado & Stefancic, 2017), Black Feminist Womanist Storytelling (Baker-Bell, 2017), Dance Literacy's kinesthetic, choreographic, and critical domains (Hong-Joe, 2002; Smith-Autard, 2002), and Black Girls' Literacies' emphasis on identity, history, collaboration, and Criticality (Price-Dennis & Muhammad, 2021).
Employing Black Feminist Womanist Storytelling methodology (Baker-Bell, 2017), this multisite study positions participants as co-narrators, centering their voices as knowledge producers (Collins, 1990; Haddix, 2015). Data collection includes semi-structured interviews with dance elders and current dancers, participant observations, reflective journaling, and video recordings of rehearsals and performances. Analysis incorporates holistic coding (Dey, 1993), narrative coding, and pattern coding (Miles et al., 2014), with participatory member checking (Doyle, 2007) ensuring authentic representation of Black girls' experiences and embodied ways of knowing.

Mina Karami
Title: How Does Our Social World Shape the Way We Speak?
Abstract: Older adults often face reduced emotional support and increased social isolation, both of which negatively impact quality of life and cognition. Although social connection has been linked to brain health and cognitive outcomes, its relationship to naturalistic language use remains underexplored. This study examined the

association between self-reported social connection and spoken discourse in 117 healthy adults over age 50, drawn from the Aging Brain Cohort at the University of South Carolina.
Participants completed PROMIS measures of social isolation and emotional support, along with two discourse tasks: the Cookie Theft picture description and Cat Rescue narrative. Transcribed language samples were analyzed with CLAN software for features such as propositional density, semantic errors, false starts, and noun usage. Correlational analyses showed that higher emotional support was associated with fewer semantic errors, lower noun proportions, and a trend toward greater propositional density. Greater social isolation correlated with more false starts. Group comparisons indicated that low emotional support was linked to increased errors and differences in noun use, while isolation effects were weaker. Regression models adjusting for demographic factors revealed limited predictive power, with small amounts of explained variance.
Overall, findings suggest emotional support exerts a stronger influence on discourse performance than social isolation. Enhanced emotional support was linked to more accurate and efficient language production. These results underscore discourse analysis as a valuable tool for identifying communication changes related to social-emotional health in aging and highlight the need for longitudinal research and potential applications in remote patient monitoring.

Sabih Khan
Title: Frequency-Engineered Contrast Patterns for Optimal Image-Based Deformation Measurement
Abstract: Digital Image Correlation (DIC) is a powerful optical method for measuring strain, deformation, and motion in materials by tracking surface contrast patterns. Conventional random speckle patterns created using random speckling of spray paint lack frequency control, leading to aliasing errors, low spatial resolution, and computational inefficiency. This research introduces a mathematically defined contrast pattern composed of three superposed sinusoidal gratings with precisely controlled frequency content spanning from well below to near the Nyquist limit. Each grating is characterized by wavelength, amplitude, and rotation angle, producing high pixel-to-pixel intensity gradients without aliasing. Covariance Matrix Adaptation Evolution Strategy (CMA-ES) optimization framework was employed to tune these parameters across multiple subset sizes and noise levels (no noise, 30 dB, 40 dB and 50 dB) ensuring minimal measurement uncertainty under realistic imaging conditions. For noise-free images, the root-mean-square error (RMSE) is below 1 mPx, while at 30 dB SNR it increases to about 8 mPx. Parametric analysis of wavelength and amplitude shows that RMSE increases with wavelength but decreases with amplitude, revealing their fundamental influence on accuracy. At a subset size of 9×9 pixels, the optimized pattern achieves roughly twice the performance of traditional speckle patterns. Compared to the conventional 21×21 subset, it also enables about four times faster analysis while maintaining equivalent deformation and motion information. These patterns can be directly printed or applied via adhesive films, allowing simple and repeatable use. This work advances DIC precision and speed while elucidating how frequency-domain pattern design governs measurement accuracy in optical metrology.

Yi Yi Li
Title: Reexamining the RAS Model: The Role of Selective Exposure and Ambient Awareness in Political Information Reception
Abstract: Low turnout in Taiwan's recent referendum shows continuing problems of political disengagement and raises questions about how citizens take in political information in today's information-rich environment. The Receive-Accept-Sample (RAS) model stresses the role of attention in reception, but it does not fully reflect social media conditions, where selective exposure and ambient awareness shape what the public see. This thesis reexamines the RAS model in Taiwan's social media context using data from the Taiwan Communication Survey. Building on the established roles of education, media use, awareness, and prior knowledge as moderators in the RAS model, this study applies hierarchical multiple regression to test how these factors together predict political information reception. The findings help explain why some citizens fail to process political information despite widespread connectivity and point to implications for democratic participation in Taiwan.

Alireza Mashreghi
Title: How We Built an Infinite River in a Small Room
Abstract: Accurate prediction of dam breach evolution due to overtopping is crucial for flood risk mitigation, especially in noncohesive earthen dams with complex erosion dynamics. This study compares a two-dimensional (2D) depth-averaged model and a three-dimensional (3D) FLOW-3D Hydro framework using three experimental cases (dam heights: 1.80 m, 0.90 m, 0.20 m). Parameters assessed included breach top width, breach maximum depth, breach discharge, and reservoir water depth. For the 1.80 m dam, the 3D model reduced RMSEs in breach width (0.018 m vs. 0.036 m), depth (0.012 m vs. 0.026 m), and discharge (0.021 m^3/s vs. 0.047 m^3/s), improving accuracy by 30–55%. At 0.20 m, results converged, with differences <7%. Turbulence modeling was critical: LES and RNG achieved the smallest breach width errors (0.014 m, 0.020 m), outperforming SST k-ω (0.033 m) and k-ε (0.041 m). Reservoir geometry had <3% effect when storage and surface area were preserved. Although 3D required 60 h versus 2 h for 2D, real-world validation of the 2015 Gibson Pond Dam failure showed superior performance, with final breach dimension errors of 3% (3D) and 5% (2D).

Emily Mathias
Title: Institutional Commitments: Not Promising.
Abstract: Colleges and universities are facing a new round of public opinion attacks, especially in regards to work done in diversity, equity, belonging, and inclusion. At the core of the attacks are misperceptions about the work institutions do and the commitments they make. Commitments to excellence are treated as equal to pledging resources and the perception is one of failed promises. The problem resides in the isotypical tendencies of institutions to use vague language as a means to convey principles and aspirations. I argue that the perception problem is a result of institutions not being clear on the kinds of commissive language they use, particularly in their mission statements and press releases. The solution? Language transparency. In this presentation, I will (i) provide a fuller picture of the perception problem, using examples from Columbia University, University of Michigan and USC,

(ii) present Sara Ahmed's nonperformative account and explain why it is insufficient for understanding institutional commitments, (iii) argue for my own account and the actionable solution that institutions can take.

Benedicta Nashiff
Title: Understanding Reversible and Irreversible Binding Mechanisms of Novel Lysyl Oxidase Inhibitors through Computational Modeling
Abstract: Lysyl oxidase (LOX) is a copper-dependent amine oxidase responsible for crosslinking collagen and elastin in the extracellular matrix. Dysregulated LOX activity contributes to pathological fibrosis and tumor progression, making it an important therapeutic target. Previous studies, including those on β-aminopropionitrile (BAPN) and pyridine-based inhibitors such as PAT-1251, have shown that inhibition can occur through irreversible covalent binding to the lysine tyrosylquinone (LTQ) cofactor in the enzyme, forming a stable Schiff-base adduct that locks the enzyme in an inactive state. Our research aims to determine whether newly synthesized LOX inhibitors follow this same irreversible mechanism or bind in a reversible, non-covalent manner. Using computational approaches, including molecular docking (Schrödinger Glide), AlphaFold-modeled LOX structures, and molecular dynamics simulations, we analyze the interaction of our compounds within the LOX active site. The focus is on the spatial orientation of reactive amine groups relative to the LTQ carbonyl, hydrogen bonding, and metal coordination that could support Schiff-base formation. Comparative analyses with known irreversible inhibitors (BAPN, PAT, and HCTL) are used to identify mechanistic similarities and predict reversibility. Through these studies, we aim to provide molecular-level insight into the binding behavior of our novel inhibitors and establish computational criteria for predicting reversible versus irreversible LOX inhibition. These findings will guide further biochemical validation and support the rational design of selective, controllable LOX inhibitors for the treatment of fibrotic and metastatic diseases.

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HEAT E PRESENTERS

Md Hasibul Amin
Title: Cross-layer Design and Optimization of Analog In-memory Computing Systems
Abstract: There has been a rapid growth in the computational demands of machine learning (ML) workloads in recent days. Conventional von Neumann architectures are not capable of keeping up with the high cost of data movement between the processor and memory, well-known as memory wall problem. In-memory computing (IMC) has been focused as a solution by the researchers, where the computation is performed inside the memory devices such as SRAM, MRAM, RRAM etc. Most commonly, the memory devices are arranged in a crossbar setting where the matrix-vector multiplication (MVM) operation is performed through intrinsic parallelism of analog computations. The conventional IMC systems require high-power signal conversion blocks to connect between analog crossbars and digital processing units, hindering efficient computation. In this dissertation, we propose In-Memory Analog Computing (IMAC) architectures that perform the MVM and nonlinear vector operation (NLV) consequently using analog functional units, eliminating the needs for costly signal conversions. Despite its advantages, computing the whole DNN in the analog domain introduces critical usability and reliability challenges. This dissertation systematically investigates these challenges and presents a set of circuit-, system-, and architecture-level solutions to mitigate their impact. Furthermore, we develop a comprehensive simulation framework to enable cross-layer design and performance optimization of IMAC systems tailored to user-defined ML workloads. Our results demonstrate that IMAC can achieve significant energy and latency savings with negligible accuracy loss, making it a compelling direction for next-generation ML hardware acceleration.

Samin Ashjaei
Title: Beyond the Ear: The Brain's Role in Understanding Speech in Noise
Abstract: Background: Age-related hearing loss (ARHL)—the third most prevalent chronic condition—affects ~50% of U.S. adults by age 60 and 80% by 85, limiting speech understanding in background noise and increasing risk of social isolation and cognitive decline. Yet, the brain mechanisms linking aging and communication difficulties remain unknown.
Research objectives: Speech-in-noise (SiN) recognition is a marker of real-world communication challenges beyond audiometric thresholds. We examined whether regional brain atrophy mediates age effects on SiN performance.
Methods: In 208 adults (20–78 y) from the University of South Carolina Aging Brain Cohort, we collected pure-tone audiometry (PTA), word-in-noise (WIN) scores, and T1-weighted MRI. We used the Graphical Brain Association Tool to assess whether gray matter (GM) and white matter (WM) volumes statistically mediated the relationship between age and WIN performance, controlling for total intracranial volume.

Results: Age accounted for 39% of WIN variance. Mediation effects were more widespread across GM than WM, suggesting that age-related decline in WIN performance is driven more by local cortical atrophy than by disruption in the connections between brain areas. Mediating GM regions (thalamus, superior frontal gyrus, dorsal anterior cingulate, precentral gyrus) support auditory-cognitive areas responsible for auditory processing, attention, working memory, and top-down modulation. Mediating WM pathways (superior parietal gyrus, middle frontal gyrus, pontine brainstem) support networks for spatial attention, cognitive control, and temporal resolution.
Discussion: ARHL is not solely a peripheral condition. Age-related atrophy in auditory, attentional, and sensorimotor hubs mediates declining SiN recognition. These findings highlight neural targets for interventions supporting communication and cognitive health in older adults.

Yarin Cohen
Title: The Second Empty Nest: When intensive grandmotherhood ends
Abstract: In Israel, grandmothers constitute the primary source of informal childcare, a role that offers significant positive outcomes. This intensive caregiving aligns with core Israeli and Western cultural values: it refills "the empty nest," reinforces the active ethos (contrasting with stereotypes of passive elderly), and maintains feminine identity through childcare—central to womanhood in Israel's pro-natalist society.
This study examined the lived experiences of Israeli older women whose intensive grandmotherhood role has diminished. Through in-depth interviews with 11 grandmothers and Moustakas' three-phase phenomenological analysis, we identified three key themes: a view of the active grandmother role as a second motherhood, the difficulties experienced following cessation of intensive caregiving, and the coping strategies developed to address the resulting void.
Participants' experiences showed both positive and negative aspects of intensive grandmotherhood phase. After cessation of their involvement some showed remarkable similarities to mid-life mothers experiencing the "empty nest" syndrome, yet the "second empty nest" appeared particularly intense within Israeli society. This intensity stems from cultural emphasis on activity as characteristic of "worthy" (non-old) individuals and childcare as a defining element of (non-old) femininity.
The "second empty nest" represents a final passage into what is culturally constructed as passive, gender-less old age, posing significant identity challenges for Israeli older women. These findings demonstrate how deeply personal experiences of life course transitions depend on their cultural construction.

Devan Gavin-Von Roue
Title: Beyond the Hero's Journey: A Metamodern Approach to Narrative
Abstract: This thesis proposes A Narrative Approach to Metamodernism, an academic and creative exploration of how narrative frameworks can evolve to meet the challenges of a fractured world. It argues that traditional heroic narratives, best exemplified by Joseph Campbell’s monomyth, are an outdated modernist model that prioritizes social obligation and self-sacrifice over personal agency. While postmodernism has offered a critique of these "grand narratives" and their totalizing solutions, it has often led to narrative cynicism and a lack of constructive alternatives.

My creative work, the animated screenplay Rave Wave: Face the Music, serves as a case study for a metamodern approach. The film's protagonist, a superhuman musician, subverts the traditional heroic call by refusing to sacrifice himself. Instead, he forges a new path, using his abilities not for individual glory but for collective action.
Through a critical analysis of animation theories from scholars such as Michel Chion and Curtis Scott, this thesis demonstrates how animation's unique symbolic elasticity makes it a powerful medium for exploring this metamodern shift. By blending theory with creative practice, this project presents a new framework for storytelling that moves beyond the hero's journey, offering a pragmatic and hopeful narrative that resonates with contemporary audiences and provides a roadmap for creators seeking to redefine heroism for a new age.

Michael Kaven
Title: Peptoid mimic of Alzheimer's disease amyloid-β protein reduces neurotoxicity of inflammatory cytokines *in vitro*
Abstract: In 2024, loved ones and caregivers of individuals with Alzheimer's disease (AD) contributed over 19 billion hours of unpaid assistance. The seventh leading cause of death in the United States, AD is a neurodegenerative disorder distinguished by the deposition of amyloid-β (Aβ) into senile plaques in the brain. Among the few available therapeutics, cholinesterase inhibitors strictly target symptoms like neuroinflammation: another medical hallmark of AD pathology in the brain. New monoclonal antibodies aim to counteract the aggregation of Aβ but are expensive.
Peptoids are protein-like molecules distinguished by centering around an amine nitrogen instead of a chiral carbon. Patented at the University of South Carolina by Dr. Melissa Moss, JPT1 is a peptoid that mimics the amino acid sequence of Aβ and has demonstrated promise as an aggregation inhibitor of Aβ. Prior to this project, effects of JPT1 on differentiated, neuronal-like human cells were unexplored.
Cultures of human macrophage cells in vitro were conditioned with an endotoxin (LPS) in the presence or absence of JPT1 treatment, and the pro-inflammatory cytokine-rich media collected as an agent for treating human neuronal-like cells in vitro. Phase contrast microscopy and metabolic neurotoxicity assays were completed to evaluate the neuronal effects. Images capture greatest death and damage in the "endotoxin alone" group, and assays reveal statistically significant reduction in cytokinemediated neurotoxicity by JPT1. In anticipation of future projects with JPT1 in animal studies, the present results of therapeutic potential in JPT1 usher in new hope for the millions of individuals with AD and their families.

Mohammad Mozammal Hosen
Title: Surface curvature-based movement of molecules on nanoparticles surface
Abstract: Nanoparticles having dimensions as small as of viruses/bacteria hold many unique features and hence they are used in a wide variety of fields of applications such as healthcare, electronics, industry, agriculture, environment etc. A major requirement for the stability of these nanoparticles is the presence of a protective layer of molecules on their surface which ultimately dictates how the

nanoparticle will behave and decides its suitability for desired applications. Thus, fundamentally it is important to understand exactly how the molecules on nanoparticles move/interact. The role of surface curvature of nanoparticles in this regard is coming into light, but their quantitative measurement is still unexplored due to their challenging nature. In our current research, we observe the instantaneous movement of molecules on nanoparticle surfaces in terms of time and transition based on the extent of surface curvature using thiol molecules on bipyramid-shaped gold nanoparticles under LASER light. The findings will serve as a guide to design nanoparticles appropriately for targeted applications and environments in a desired manner.

Price Lassahn-Worrell
Title: The Sound of Becoming Whole: Lessons from a Promiscuous Prefix
Abstract: This dissertation investigates the semantics and distribution of the Old English prefix ge- and its Proto-Germanic antecedent *ga- across multiple early Germanic languages, with the goal of understanding both its historical development and methodological implications for the study of word-formation. The project combines traditional structuralist approaches to semantics—particularly lexical field theory and componential analysis—with morphosyntactic distributional study and modern computational methods, including regression models, clustering, and predictive machine learning.
The study is built on lemma-level datasets for Gothic, Old Saxon, and related languages, with each entry annotated for part of speech, inflectional class, and meaning across translation equivalents. These datasets provide the basis for testing long-standing philological assumptions: for example, whether the prefix favored specific parts of speech, whether it clustered within particular semantic domains, and whether cross-linguistic evidence can predict later Old English developments. Each language is analyzed on its own terms before cross-comparison, with Old English reserved for last, allowing earlier distributions to frame its distinctive trajectory. Findings suggest that the prefix's original collective and associative functions narrowed and expanded in different directions across the Germanic branch: in some cases drifting into aspectual or lexicalized roles, in others eroding into a near-empty morphological marker. The dissertation also demonstrates how computational tools can bring fresh precision to historical linguistics, complementing rather than replacing close philological analysis. Finally, it models a transparent approach to integrating AI-assisted analyses in a new domain and the need for ethical reflection on transparency and authorship in scholarly research.

Timothy Philbeck
Title: Broken Hearts and Troubled Minds: Modeling Stress Induced PPD and CVD
Abstract: Maternal mortality in the Unites States is the highest among industrialized nations and continues to rise, with cardiovascular disease (CVD) and mental health disorders as leading contributors. Postpartum depression (PPD) confers a 70% increased risk of developing CVD within five years of delivery, suggesting shared mechanisms. Psychosocial stress is a major risk factor for PPD and CVD, yet its effects on postpartum cardiovascular and behavioral outcomes remain understudied.

This study examined the impact of gestational psychosocial stress on postpartum mood-relevant behaviors and cardiac function.
Time-mated and virgin female Wistar rats were exposed to control handling or witness-stress (WS), a modified social defeat paradigm, on gestational days 8-12. Echocardiograms were conducted on postpartum days 14 and 22, and plasma catecholamines were quantified by HPLC on days 23-25.
WS increased burying duration, a hypervigilant phenotype, in non-pregnant females during the first ($p=0.066$) and fifth ($p=0.001$) exposures. Six days later, context re-exposure revealed a stress x parity interaction ($p=0.01$), with non-pregnant females continuing to bury while postpartum females did not. Additionally, WS exposure increased avoidance behavior in postpartum females compared to non-stressed postpartum females ($p=0.04$). Gestational WS reduced stroke volume ($p=0.03$), enlarged left atrial area ($p=0.01$), and elevated heart rate ($p=0.053$). Non-pregnant females exhibited increased plasma epinephrine ($p=0.009$), while norepinephrine showed a stress x parity interaction ($p=0.04$), with gestationally stressed females displaying elevated levels ($p=0.057$) that correlated with left ventricular mass ($R2=0.46$, $p=0.01$).
Together, these findings highlight lasting WS effects in PPD-relevant behaviors and cardiac health that potentially result from altered autonomic function.

Shahide Sayadian
Title: CO_2 Transformed: Fuel for Earth, Oxygen for Mars
Abstract: Carbon dioxide is often seen as the villain of climate change, but what if it could become our ally? My research explores microtubular Solid Oxide Electrolysis Cells (SOECs), devices that can split CO_2 into carbon monoxide and oxygen. The oxygen can sustain life, while the carbon monoxide can be turned into syngas—a safer, more practical fuel than pure hydrogen. This technology holds promise not only for reducing greenhouse gases on Earth but also for producing oxygen from the CO_2-rich atmosphere of Mars.
Using advanced numerical simulations, I study how SOECs operate under different conditions. Simulations are powerful tools, allowing us to explore complex designs and identify key parameters that govern performance. But SOECs face a stubborn challenge: carbon deposition, a process that clogs the cells and shortens their lifetime.
My findings reveal that the Boudouard reaction, driven by high CO concentrations, is the main pathway for carbon buildup. Deposition is most likely when CO levels are high and CO_2 is low, especially in zones where gas reactions are intense. The good news is that it can be mitigated. Strategies such as optimizing fuel mixtures, increasing temperature, raising inlet velocity, lowering outlet pressure, and improving fuel permeability all reduce the risk.
By understanding and addressing this challenge, my work helps pave the way for durable, carbon-neutral energy solutions on Earth—and potentially oxygen production for the first human explorers on Mars.