Undergraduate Research Scholars Symposium

Abstract Book

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Memorial Student Center | College Station, Texas

Undergraduate Research Scholars Thesis Program

Office of Undergraduate Research | Division of Academic Affairs

TEXAS A&M UNIVERSITY

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About Us

About the Office of Undergraduate Research

The Office of Undergraduate Research at Texas A&M University enhances the undergraduate experience for all students. Our initiatives foster connections between students, faculty, staff, as well as promote interdisciplinary collaboration and professional development.

About the Undergraduate Research Scholars Thesis Program

The Undergraduate Research Scholars (URS) thesis program offers undergraduates the opportunity to engage in independent research, scholarly inquiry, and creative work under the mentorship of a Texas A&M faculty mentor. The program is designed to support participating students and their faculty advisors through the development of an undergraduate thesis and provides a structured pathway for students to gain valuable experience in communication, critical thinking, and project management.

The *Undergraduate Research Scholar* distinction earned by completing the program is the only stand-alone, university-level, honors distinction for undergraduate research at Texas A&M University.

About the Undergraduate Research Scholars Symposium

The Undergraduate Research Scholars Symposium is a low-stakes presentation venue for students in the URS thesis program. The event is purposely focused on presentation practice and constructive feedback so our Scholars can continuously improve their research, writing, and presentation skills.

The entire campus is invited to visit presentations throughout the day, but faculty, staff, and post-docs are specially invited to serve as “Active Listeners” who take on a direct role in shaping the future of our undergraduate researchers.

Learn how to get involved with the Office of Undergraduate Research by visiting https://ugr.tamu.edu or emailing ugr@tamu.edu.

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Oral Presentations

Oral Session 1
9:00 AM-10:15 AM CT
Room B

Oral Session 1: 9:00 AM-10:15 AM CT

Room: MSC 2300 B

Presenter #1: *Smrithika Ammanur*

Major: Computer Science

Faculty Advisor: Dr. Dmitri Loguinov

Memory-Optimized Key-Value Pair Sorting and Access

With the rise of large-scale data generation, storage, and processing in recent years, efficient sorting and rapid access to enormous volumes of information have become critical to modern computing. Open-source implementations of big data frameworks (e.g., Hadoop, Spark) fundamentally rely on sorting key-value pairs to reorganize billions of records across distributed systems, but continue to face an unresolved performance tradeoff. In particular, current approaches prioritize sorting speed by moving only keys with pointers to values, avoiding the expensive movement of large key-value records. Yet, this gain in efficiency at the sorting phase is subsequently lost when accessing the values due to the severe bottleneck incurred by random memory access. Meanwhile, sorting the key-value records together allows for rapid, sequential value access after the sort is complete, but this approach slows sorting significantly as record sizes grow. To examine this problem in detail, we extend an existing state-of-the-art, in-place, radix sort, Vortex, to account for key-value pairs of varying sizes. The main contributions of this work are twofold: (1) extensive benchmarks quantifying the cost of carrying the key-value during the sorting process versus the cost of shuffled, pointer-based access, (2) a proposed hybrid approach that balances sorting efficiency with sequential access performance.

Oral Session 1: 9:00 AM-10:15 AM CT
Room: MSC 2300 B

Presenter #2: *Aiden Carr*

Major: Computer Science

Faculty Advisor: Dr. Dmitri Loguinov

A More Efficient Key Value Pair Sorting System: A Comparison of Compressed and Uncompressed SSE and AVX2

In the world of big data, sorting plays an important role in finding trends hidden within. While sorting networks are highly efficient, they become cumbersome when trying to sort large key value pairs. This paper will explore a method of eliminating the extra work by compressing down the key value pairs. To do this the paper will build off of existing low level algorithms to increase efficiency. The intended effect of the additions will be for there to be higher levels of parallelism throughout the instructions. This parallelism will hopefully offset the increased overhead necessary to implement the compression. There are two main sorting networks that will be looked at, SSE and AVX2. These networks are intended to be on the tail end of a large high level sorting algorithm and focused on highly optimized sorting of small buckets of similar values. The compression will be done by dropping the values and allowing the networks to only sort the keys, allowing for more keys to be sorted at once and a less cumbersome sort with less data to move around. This paper will compare the uncompressed and compressed versions of the SSE and AVX2 sorts to observe whether or not compressing increases efficiency.

Oral Session 1: 9:00 AM-10:15 AM CT
Room: MSC 2300 B

Presenter #3: *Soham Nagawanshi*

Major: Computer Science

Faculty Advisor: Dr. Samson Zhou

Learning-augmented Algorithms for Obtaining Maximum Likelihood Cell Lineage Trees

When studying various tumors, researchers often rely on single-cell DNA sequencing (scDNA-seq) to observe genotypes. Modeling observed genotypes' evolutionary histories can help researchers gain insights into cancer-related diseases as these diseases are driven by the gradual acquisition of mutations. In practice, however, observed genotypes are often noisy as sequencing tools can fail to identify an occurred mutation (false negative) or, at a lower rate, introduce false positive mutations. The maximum likelihood tree reconstruction problem aims to minimally correct the observed genotype and obtain a cell lineage tree that best explains the evolutionary history of the corrected (inferred) genotype. Some existing methods solve this problem optimally for limited cell count (i.e. <100), but finding the optimal tree is known to be intractable for hundreds of cells. In other disciplines, algorithms have combined heuristics with provably optimal algorithms to bypass hardness results. Known as learning-augmented algorithms, these algorithms utilize auxiliary information provided by imperfect "oracles" such as machine-learning models, field experts, and various statistical models to obtain algorithms with stronger theoretical guarantees. Accordingly, this work introduces learning-augmented algorithms as a tool for inferring tumor evolution trees. The introduced algorithms are scalable and provably guaranteed to produce a maximum likelihood tree in polynomial time under some assumptions. Additionally, this work demonstrates the practicality of the algorithms on synthetic and hybrid real-synthetic datasets.

Oral Session 1: 9:00 AM-10:15 AM CT
Room: MSC 2300 B

Presenter #4: *Dominic Garofolo*

Major: Electrical Engineering

Faculty Advisor: Dr. Suin Yi

True Random Number Generation Using Commercial 232-Layer 3D NAND Flash Memory

We propose a True Random Number Generator (TRNG) using commercial off-the-shelf (COTS) 3D NAND Flash memory. 3D NAND flash memory is widely used in consumer and enterprise applications, including solid-state drives (SSDs), mobile devices, and memory sticks. The experiments in this project are conducted on a platform supporting Micron's 232-layer 8th generation 3D NAND flash chip (BGA-154 package). During read operations, flash memory cells exhibit both thermal noise and random telegraph noise (RTN). Due to the intrinsic randomness of these noise sources, they can be exploited for true random number generation. Furthermore, the increased cell density of later-generation 3D NAND may amplify the intrinsic noise-induced randomness. The proposed TRNG extraction method uses the Read Offset instruction to shift the read reference voltage during read operations. This instruction is an advanced feature supported only by later-generation NAND devices for the error correction code (ECC) purposes and has not been widely utilized in prior TRNG approaches based on 3D NAND flash. By shifting the read reference voltage we are able to very accurately match the threshold voltage of the individual NAND cells in the devices. When operating at the threshold voltage, the readout becomes highly unstable to be ‘1’ or ‘0’ and serves as the primary entropy source for this TRNG mechanism. Also, depending on the writing methodology of memory cells, the noise magnitude can be further tuned to maximize the throughput of random number generation. In the evaluation of this experiment we can show the statistical quality of these random bits along with achievable throughput. Importantly, this approach can be implemented purely through firmware in the NAND controllers and does not require any additional hardware. As a result, this work provides a low cost and easily deployable TRNG for a wide range of systems that already incorporate 3D NAND flash memory.

Oral Session 1
9:00 AM-10:15 AM CT
Room D

Oral Session 1: 9:00 AM-10:15 AM CT

Room: MSC 2300 D

Presenter #1: *Anneliese Medrano*

Major: Political Science

Faculty Advisor: Dr. Tianna Helena Uchacz

Renaissance Ornament Prints and the Collaboration of Practitioners

This research project explores the relationship between sixteenth-century ornament prints and the creation of Renaissance-era decorative art objects. Specifically, it begins with a series of seventeen sheets of ornamental designs recommended for use by glass engravers, published in Antwerp circa 1565. The project examines how glass artisans and their collaborators may have used these prints, along with similar ones, in workshop practices to bring a complex glass object to life. To this end, I am experimenting with a variety of glassworking techniques, inspired by a 16th-century vase found in the Metropolitan Museum of Art in New York that features glassblowing, molding, engraving, painting, and gilding. I am developing a series of process objects guided by contemporary expert glass artists and scholars to better understand each technique individually and how they might have been combined in ornate decorative arts. Additionally, I am exploring guild structures and regulations in Renaissance Antwerp to gain insight into how various artists, possibly from different workshops and artisanal trades, might have worked together to create such a vase. Currently, there is no comprehensive scholarly study of how Renaissance ornament prints were used in the creation of decorative art objects. My research begins to address this gap by examining a case study of glass art, highlighting the challenges of adapting printed designs for glasswork and their role within a broader artisanal ecosystem.

Oral Session 1: 9:00 AM-10:15 AM CT
Room: MSC 2300 D

Presenter #2: *Kyla Beck*

Majors: Agribusiness

Faculty Advisor: Dr. Linda Radzik

Fairness and Constitutional Limits: Investigating California's Proposition 12 and the Limitations of Interstate Authority

Applying sustained pressure to the foundation of American federalism, the Commerce Clause has long stood at the center of interstate authority and the regulation of powers between the states. As generations pass, developing states have begun to realize this authority, establishing regulations that seem to only serve those within state lines. This paper closely examines the aggregate effect of state-wide regulations on interstate commerce that spill over into the freedoms of other states, diminishing the very issue the Commerce Clause was designed to resolve. Through utilization of legal doctrines, Supreme Court decisions, and writings of legal philosophers, this paper highlights the disparity in intent of the Clause and actual implementation and interpretation at the highest appellate level. To ground this theoretical inquiry in a realistic context, California's Proposition 12 (2023) is used as a case study illustrating the tangible consequences of interstate overreach. By evaluating both economic and moral arguments surrounding Proposition 12, this paper ultimately argues that current Commerce Clause jurisprudence inadequately constrains state action that produces substantial extraterritorial effects. This paper argues that modern Commerce Clause jurisprudence, particularly under the Pike balancing framework, fails to meaningfully constrain state regulations with substantial extraterritorial effects, thereby eroding the constitutional balance of federalism. The analysis concludes that without clearer doctrinal boundaries or renewed federal oversight, extraterritorial state regulation will continue to destabilize national markets and weaken democratic legitimacy. Ultimately, this research calls for a more predictable and equitable framework that preserves the balance between state autonomy, federal authority, and the foundational promise of self-government within the American republic.

Oral Session 1: 9:00 AM-10:15 AM CT
Room: MSC 2300 D

Presenter #3: *Nicholas Le*

Majors: Biomedical Sciences

Faculty Advisor: Dr. Stjepan Meštrović

Anomie, Alienation, and the Breakdown of the Sick Role: A Sociological Analysis of War Crimes and Military Health

This thesis examines U.S. military violence against detainees and civilians during United States deployment in the Middle East. Importantly, it seeks to illuminate a sociological phenomenon rooted in institutional pathology rather than as a series of isolated moral failures. While incidents of war crimes of military abuse are often treated as discrete events, this analysis argues that they reflect recurring structural conditions within military institutions. Drawing on Ã‰mile Durkheim's anomie, Talcott Parsons' sick role, and Karl Marx's alienation, this thesis offers a unified sociological framework for understanding how institutional disorganization, untreated trauma, and coercive labor conditions converge to normalize violence and undermine health. Methodologically, this research employs qualitative textual analysis of court-martial transcripts, trial documents, and testimonies related to these cases, treating them as sociological texts that reveal systemic patterns. Through systematic coding and comparative theoretical synthesis, this thesis demonstrates how anomie, alienation, and the collapse of the sick role function as interconnected mechanisms across multiple cases. By extending classical sociological frameworks to a comparative analysis of modern military atrocities, this project underscores their enduring relevance for understanding institutional violence, occupational trauma, and state-inflicted harm. Collectively, these cases reveal not exceptional breakdowns, but patterned outcomes of structural conditions that erode health, morality, and social order within powerful institutions.

Oral Session 1
9:00 AM-10:15 AM CT
Room E

Oral Session 1: 9:00 AM-10:15 AM CT

Room: MSC 2300 E

Presenter #1: *Priyadarshini Chandrani*

Majors: Anthropology, Biology

Faculty Advisor: Dr. Keegan Selig

Dental Wear & Dentine Deposition in *Cebus capucinus* and *Sapajus apella*

Dentine is a layer of the teeth that lies under the surface layer of enamel, and serves as a buffer that protects the pulp at the center of the teeth. This protection is important, since pulp provides nutrients to and maintains homeostasis of the teeth, and can impact health throughout the body. Throughout the life of the tooth and as needed, dentine is deposited by the pulp into the pulp cavity. This study will examine the relationship between abrasiveness of diet and dentine deposition through comparison of second mandibular molar teeth in Cebus capucinus (colloquially known as white-faced capuchins) and *Sapajus apella* (colloquially known as brown-faced capuchins). These monkeys belonging to the subfamily Cebinae shared an extinct common ancestor in the Late Miocene era, before diverging evolutionarily around 6.2 million years ago. *Sapajus apella* has stronger enamel, and a more abrasive diet than Cebus capucinus. I will analyze if there is a statistically significant difference in dental wear between the two taxa, and the nature of the relationship between dental wear and dentine deposition. If Cebus capucinus has more dentine deposition, that may be an indication that thinner enamel with a less abrasive diet correlates with greater dentine deposition to protect the pulp, due to the weaker surface level defenses. If there is more dentine deposition in *Sapajus apella*, that may be an indication that thicker enamel with a more abrasive diet correlates with greater dentine deposition to protect the pulp, considering that those teeth have to endure more stress. The results of this study will further the understanding of mandibular molar root morphology adaptations in primates.

Oral Session 1: 9:00 AM-10:15 AM CT
Room: MSC 2300 E

Presenter #2: *Riya Tom*

Major: Chemistry

Faculty Advisor: Dr. Heidi Vanden Brink

Changes in Ovarian Morphology in Post-menarcheal Adolescents using Magnetic Resonance Imaging (MRI)

Ovarian morphology is used in adults for the diagnosis of Polycystic Ovary Syndrome (PCOS), a hormonal disorder that affects between 5% to 9% of women worldwide. However, accurate and early diagnosis of PCOS during adolescence is hampered by a poor understanding of how ovarian morphology changes in the years following menarche; multi-follicular ovaries are common in the early post-menarcheal years, which overlaps with features of a PCOS-defined polycystic ovarian morphology. However, it is unclear when divergences in ovarian morphology among adolescents with a higher risk of developing PCOS can be detected. To begin to address this knowledge gap, we conducted a pilot study to assess changes in ovarian morphology using MRI among adolescents with and without irregular menstrual cycles - one of the diagnostic features of PCOS. In this study, seven post-menarcheal adolescents (M = 0.86, SD = 0.43 years post-menarche) completed three study visits each three months apart. A T2 coronal MRI of the mid-section at a slice thickness of 1.2mm was conducted, along with venipuncture and anthropometry. Menstrual cycle dates were recorded during study participation to assess the effect of menstrual cycle phase on ovarian outcomes over time. MRI scans were analyzed offline using a generic DICOM reader. The following ovarian endpoints were obtained: ovarian area, number and diameter of antral follicles, follicle distribution pattern, and overall image clarity. Whether gynecological age or menstrual cycle phase predict changes in ovarian morphology will be determined using mixed models. Data analyses are underway. We anticipate that follicle number and diameter will decrease over time in adolescents with regular menstrual cycles, consistent with a resolution of a multi-follicular ovary that defines adolescence. However, in adolescents with menstrual irregularity, we anticipate that follicle number will not decline, reflecting aberrant reproductive axis maturation.

Oral Session 2
10:30 AM-11:45 AM CT
Room B

Oral Session 2: 10:30 AM-11:45 AM CT

Room: MSC 2300 B

Presenter #1: *Fabiana Baez, Miranda Martinez Rossi*

Major: Biology, **Major:** Psychology

Faculty Advisor: Dr. Marian Eide

Pregnancies in Texas: A Narrative Medicine Approach to Understanding Lived Experiences Post-Roe v. Wade

Recent changes in reproductive healthcare practices, following the implementation of Texas Senate Bill 8 (SB8), a law that limits access to abortion care after an early pregnancy, alter how reproductive healthcare services are delivered. These changes have affected patients' emotional well-being, the availability of information, and their reliance on support systems, as well as their interactions with healthcare providers. A reproductive justice framework that emphasizes equitable access to care, informed decision-making, and respect for patient autonomy serves as the foundation for our research. It focuses on how healthcare professionals may more effectively satisfy patient demands while also examining how pregnant women are treated in evolving clinical environments. This study prioritizes patient perspectives and lived experiences using qualitative techniques, guided by a narrative medicine approach. Comprehensive semi-structured interviews were conducted with individuals who became pregnant after 2022. Thematic analysis of the interview transcriptions identified recurring themes, such as emotional responses, access to care, communication with healthcare providers, support networks, and the influence of social and economic factors. This approach facilitates a broader understanding of pregnancy experiences by considering the social and structural factors influencing reproductive healthcare beyond traditional clinical outcomes. According to preliminary data, participants' overall experiences were characterized by increased emotional strain and uncertainty, as well as difficulties navigating healthcare services and obtaining clear information in regard to SB8 law. Several participants emphasized the importance of relational and social support, particularly views of partner engagement, in managing stress and making decisions during pregnancy, which contributed to participants' sense of agency and emotional well-being. The participants' descriptions of differing degrees of support and communication in healthcare settings highlighted opportunities for improved patient-provider relations. Healthcare professionals can promote compassionate, patient-centered care and enhance communication in challenging clinical settings by prioritizing patient stories. Our research demonstrates the value of a narrative-medicine approach to patient experiences and providing effective care. We argue that it is crucial to incorporate narrative knowledge into medical practice and education to promote equitable, responsive, and patient-centered healthcare.

Oral Session 2: 10:30 AM-11:45 AM CT
Room: MSC 2300 B

Presenter #2: *Gabriel MacMurray*

Major: History

Faculty Advisor: Dr. Adam Seipp

Aggies in Foreign Militaries

Examining the experiences of different Aggies who enlisted in foreign militaries during World War II, many were persistent in their efforts to join a foreign military, their eagerness to fight evident in their actions. One such individual was Clarence Wisrodt, Jr., who was initially barred from enlistment due to Canadian recruitment restrictions. Wisrodt Jr. seized the opportunity to join once the pathways for American volunteers opened. Wisrodt's parents were hesitant about the idea of their son joining such a dangerous conflict and withheld documents required for enlistment to stall joining the Royal Canadian Air Force. Wisrodt's experience reflects a broader national climate shaped by post World War I isolationism. Through political pressure, legal barriers, and social stigma, the United States heavily deterred civilian involvement in foreign conflicts, especially those in which the country was not actively engaged in. Following the outbreak of World War II, many in America detested the idea of joining the conflict, but a select few were eager to join the war even before Pearl Harbor. Young men seeking purpose, adventure, and identity during a time of immense change sought out enlistment in groups like the American Volunteer Group (AVG) or the Royal Canadian Air Force (RCAF) to fight against the Axis Powers. This paper argues that Aggies who volunteered before Pearl Harbor were driven by ideological commitment, personal ambition, and a desire for purpose, while post Pearl Harbor volunteers were increasingly influenced by patriotism. By studying the motivations of eight different Aggies, this paper seeks to understand their stories through the usage of enlistment documentation, letters, newspapers, biographies, and yearbooks to explain the journey of Aggies in foreign militaries through World War II.

Oral Session 2: 10:30 AM-11:45 AM CT
Room: MSC 2300 B

Presenter #3: *Lillian O. Haynes*

Major: International Affairs

Faculty Advisor: Dr. Robert F. Carley

The Tide Remembers: Puerto Rican Resistance and Colonial History in the Face of Cultural Erosion

Since the so-called 'discovery' of Puerto Rico in 1493—and its later 500-year colonization—the island's beaches have served as a lifeline for Puerto Ricans, representing their livelihoods, their cultural identities, and their political struggles. Literally, these coastal spaces are a place of constant dispute, as they are threatened by privatization, destroyed due to weak environmental protections, and exploited by foreign firms and mass tourism. Figuratively, the beaches represent the diasporic displacement and colonial legacy of the island, demonstrating an ongoing fight for cultural independence and celebration in the face of centuries of external, oppressive control. Through a series of interviews, first-person media documentation and archival analysis, this research paper aims to answer the following question: How do the beaches of Puerto Rico reflect the island's ongoing struggles with colonialism, gentrification, and environmental change, and to what extent may they provide an avenue for resistance and cultural independence? Through Henri Lefebvre's framework on spatial practice within The Production of Space, this ethnographic research study showcases the overconscription of coastal spaces, as Puerto Ricans are both vindicated and condemned within the waters they call home.

Oral Session 2
10:30 AM-11:45 AM CT
Room D

Oral Session 2: 10:30 AM-11:45 AM CT

Room: MSC 2300 D

Presenter #1: *Raphael Cacho*

Majors: Mathematics, Physics

Faculty Advisor: Dr. Alexei Sokolov

Line Spectroscopy and Single Pixel Imaging Utilizing a Rotating Grating

Imaging and spectroscopy are essential tools in many scientific fields, including chemistry and biology, to observe the structure of materials. In traditional spectrometers and cameras, CCD or CMOS sensors are used, which are arrays of sensors. Due to how these sensors need to convert light into electrical information for all pixels, they have a limitation on how fast they can capture images, or the maximum framerate. One way to increase the maximum framerate is to reduce the number of sensors or pixels; in this case, to a single pixel. To perform single-pixel imaging, we use a rotating grating or disk with slits, with a lens to focus the image through the grating onto a single photodetector. This study showcases the testbenches for both single-pixel imaging and line spectroscopy. In addition, I showcase the different custom algorithms used to reconstruct both images and line spectra. For the testbenches, we use a laser and a Powell lens to produce a laser line, with different sections blocked to simulate a spectral line. Then we use a beam expander to create a square of light and block regions to simulate an image. Using these testbenches, we validate the effectiveness of various reconstruction methods for single-pixel imaging and spectroscopy.

Oral Session 2: 10:30 AM-11:45 AM CT
Room: MSC 2300 D

Presenter #2: *Katie Mendoza*

Majors: Business Honors, Management

Faculty Advisor: Dr. Heather Lench

The Relationship Between Sadness and Attention Lapses

Breaks in attention are a frequent experience in everyday life, often resulting in negative outcomes. As such, causes of increased attention lapses are of interest. Mind-wandering, a type of attention lapse, has an established relationship with negative mood, but the effects of sadness specifically on attention breaks have not been examined. Due to literature findings that sadness narrows attention on the source of sadness, we hypothesize that sadness would result in greater lapses in attention pertaining to tasks. This study examines the effects of sadness on task performance. Positive (amusement and desire), neutral, and negative (anger and sadness) emotions were induced using the Interactive Affective Picture System (IAPS) prior to completing a mind-wandering task. The solicitation was effective in increasing sadness. Following this, a go/no-go association task (GNAT) was used to measure lapses in attention, with increased response time and errors indicating greater lapses. Data analysis is ongoing. Hypothesized results would include effective emotion induction and a significant increase in attention lapses in the sadness condition compared to the neutral condition. The study will contribute to the understanding of when sadness is beneficial and when it is harmful, and will shed new light on the functions of sadness and performance outcomes.

Oral Session 3
12:15 PM-1:30 PM CT
Room B

Oral Session 3: 12:15 PM-1:30 PM CT

Room: MSC 2300 B

Presenter #1: *Ryan Gruen*

Major: Chemistry

Faculty Advisor: Dr. David C. Powers

Investigating the Oxygen Atom Transfer Photochemistry of Manganese Porphyrin Complexes

Metalloporphyrins are integral parts of many biological systems, including the active sites of hemoglobin, horseradish peroxidase, and cytochrome P450. These enzymes contain iron and manganese centers that can reversibly bind and transfer oxygen, serving roles such as oxygen transport in the body and hydroxylation, which converts molecules into a hydrophilic form. Inspired by their versatile reactivity in biological systems, synthetic metalloenzymes have been developed as powerful group-transfer catalysts, with seminal reports from Groves and co-workers on C–H hydroxylation in cyclohexene using MnTPPCl and FeTPPCl. These transformations have been postulated to proceed via the intermediacy of a high-valent Mn porphyrin; however, their fleeting lifetimes render their characterization difficult. In this work, photolysis of an MnTPPCl complex of dibenzoselenophene-5-oxide (DBSeO) has generated a high-valent Mn-oxo complex to characterize the intermediate species and provide insight into the reaction mechanism. DBSeO was chosen because it has been shown to act as a source of atomic oxygen when irradiated with 300 nm light. Experiments monitoring photoreactions through NMR have demonstrated that the MnTPP(DBSeO)Cl complex transfers oxygen across C=C double bonds to form epoxides in yields up to five times that of the free DBSeO ligand. In addition, the reaction is stereospecific, resulting in the formation of only the cis product when cis-4-octene is used as the substrate. This indicates a concerted mechanism which involves the presence of a Mn-oxo intermediate. Since porphyrin complexes have distinctive UV-vis spectra indicative of their oxidation states, experiments monitoring photolyses by UV-vis spectroscopy have been conducted and revealed a blue shift in the Soret band of MnTPP(DBSeO)Cl from 478 nm to 438 nm. Current work focuses on attempting to simulate spectra of possible intermediates using time-dependent density functional theory to determine the identity of the intermediate, as well as attempting C–H hydroxylation reactions photochemically.

Oral Session 3: 12:15 PM-1:30 PM CT
Room: MSC 2300 B

Presenter #2: *Hannah von Suskil*

Major: Biology

Faculty Advisor: Dr. Kristine Korzow

An Investigation into the Taxonomy of Extinct North American Raptors

The taxonomy of extinct animals can be difficult to determine from morphology alone. Morphological identifications are often muddled by convergent evolution, a lack of intact specimens, or incomplete reference collections. While DNA is the gold standard for taxonomy, it requires excellent preservation as well as extant relatives with available sequence data to provide clear taxonomic resolution. In this thesis, I introduce the use of Zooarchaeology by Mass Spectrometry (ZooMS) as an alternative to DNA analysis to resolve the relationship between three extinct raptor species from Rancho La Brea in San Diego, California and their modern-day relatives. Attempts at extracting DNA from La Brea have not yet been successful, leading to many phylogenetic relationships being inferred from morphology alone. ZooMS is a widely used Peptide Mass Fingerprinting (PMF) technique used to identify morphologically indistinct faunal remains. ZooMS utilizes PMF to determine single amino acid polymorphisms, or SAAPs, in the sequence of collagen type I (Col1), a triple-helical structural protein that makes up about 95% of the proteins in bone. This abundance, paired with its stable structure and use as a scaffold for bone mineralization, allows for higher stability over longer timescales than DNA, making it more widely applicable than DNA in archaeological or paleontological contexts. To investigate taxonomic relationships, I first created a collagen reference library of several raptor species. Next, I compared them amongst themselves, then against the Pleistocene raptors. I found genus-level distinction within raptor families; species-level distinction is possible in more divergent genera. Using ZooMS, I have illustrated the ability to biochemically perform taxonomic placement of extinct raptors. Additionally, I found that one of the specimens had been misidentified, illustrating the difficulties in relying on morphology. Sufficient evidence is present to suggest that ZooMS can resolve phylogenetic relationships, determining the evolutionary origin of Pleistocene-era raptors.

Oral Session 3: 12:15 PM-1:30 PM CT
Room: MSC 2300 B

Presenter #3: *Jackson Belobrajdic*

Majors: Mathematics, Chemical Engineering

Faculty Advisor: Dr. Xuejun Zhu

Investigating the Degradation of Polyurethane by Microbial Enzymes

Plastic pollution is an urgent problem threatening the future of our planet. Since many plastics are chemically stable, they persist in the environment long after disposal and resist degradation. However, the use of biological tools like enzymes is a promising method to reduce the impact of these stubborn pollutants. Additionally, the specificity of enzymes grants the potential to transform plastic waste into valuable chemicals, which would benefit the economy as well as the environment. Polyurethane is a diverse family of plastics that is commonly used in foams and coatings. Unlike other types of plastics, polyurethanes are defined by their linkages rather than a specific repeating monomer. This diversity makes studying polyurethane reactions complex. In this work, we investigate the ability of a previously identified Pseudomonas bacterial isolate to degrade polyurethane. After selecting genes using genomic analysis of the isolate, we showed that one enzyme has the ability to reduce the opacity of polyurethane on agar plates, suggesting its role in degrading the plastic. Subsequently, mass spectrometry was used to attempt to identify the specific breakdown products of the reaction. These findings further our understanding of the capacity of microbes to degrade plastic, which has implications for the health of our environment.

Oral Session 3: 12:15 PM-1:30 PM CT
Room: MSC 2300 B

Presenter #4: *Sofia C. Prieto*

Major: Economics

Faculty Advisor: Dr. Pedro Bento

Algorithm to Audience: The Economics Behind What We Watch and Social Media's Role in Shaping Movie Consumption

The contemporary film industry operates within a rapidly evolving digital environment in which consumer decision-making is increasingly shaped by social media, streaming platforms, and behavioral forces rather than by traditional price and quality-based considerations alone. This thesis examines how structural changes in film distribution and marketing interact with behavioral economic mechanisms, such as social learning, network effects, and hype dynamics, to influence audience demand and viewing behavior. Drawing on literature from the economics of movies, cultural economics, and media studies, this project synthesizes research on box office demand, blockbuster dynamics, and the role of digital platforms in filmed entertainment. Prior scholarship highlights how digitalization has transformed the structure of the film industry, altering the timing of releases, the prominence of streaming services, and the relative importance of theatrical release. At the same time, recent studies on social media marketing demonstrates how trailers, hashtags, online discussion, and user-generated content shape consumer expectations and "want-to-see" behavior before and during a film's release. This research situates these findings within a behavioral economics framework, emphasizing how social proof, fear of missing out (FOMO), and algorithmic amplification can generate demand momentum that departs from classical rational-choice models. This project also considers how trend-driven, spoiler-light content on short-form platforms such as TikTok creates curiosity-based engagement that fuels fear of missing out. By withholding major plot details while signaling cultural relevance, these posts can generate surges in demand that encourage consumers to attend theatrical releases in real time. By examining case studies and patterns identified in existing empirical work, this thesis explores how digital media environments contribute to unequal market outcomes, including the concentration of attention around blockbuster releases and the increasing polarization between mainstream films and niche titles. Ultimately, this project aims to contribute to a broader understanding of film consumption as a socially mediated economic activity. Its findings have implications for distributors, streaming platforms, and policymakers interested in consumer welfare, market power, and cultural production in the digital era.

Oral Session 3
12:15 PM-1:30 PM CT
Room D

Oral Session 3: 12:15 PM-1:30 PM CT

Room: MSC 2300 D

Presenter #1: *Anya Stolyarova, Prasenjeet Ingole*

Major: Biology, **Major:** Neuroscience

Faculty Advisor: Dr. Akhilesh K. Gaharwar

Evaluation of a Hemostat for Postpartum Hemorrhage in the Physiological Environment

Postpartum hemorrhage (PPH), or excessive bleeding following labor, is the leading cause of maternal mortality worldwide. PPH is first treated with uterotonics that promote uterine contractions, and then with more invasive procedures including uterine balloon tamponade, uterine artery ligation, and hysterectomy if hemostasis is not achieved. Physical interventions are often associated with obstetric morbidities and infertility following treatment. To address these shortcomings, we developed a minimally invasive hydrogel composed of Laponite XLG (nSi), polydopamine conjugated to gelatin (PDA-gel), and oxytocin. nSi is a shear-thinning synthetic nanosilicate clay that provides injectability in addition to activation of the coagulation cascade, defining it as an injectable hemostatic material (IHM). PDA-Gel grants the IHM adhesive properties by hosting electrostatic interactions with the hydrated uterine environment. Lastly, oxytocin stimulates uterine contractions which aid in hemostasis. For clinical applications, the material should promote coagulation and tissue healing without posing biological threats. Our aim is to assess the IHM's physiological effects and ability to promote coagulation. The biocompatibility of the hemostats has been determined through sterility, cytocompatibility, biodegradability, and hemolysis assays. These assessments observe the material's interaction with tissue, blood, and innate degradative agents. Optimal uterotonic concentration was determined by obtaining half maximal inhibitory concentration of oxytocin on smooth muscle cells. The hemostatic nature of the IHM was evaluated via inversion clotting tests, RBC adhesion, and platelet adhesion. Whole blood clotting was utilized to optimize IHM formulation. The IHM will be further analyzed for translational viability using in vivo animal studies.

Oral Session 3: 12:15 PM-1:30 PM CT
Room: MSC 2300 D

Presenter #2: *Joshua Skrehot*

Major: Neuroscience

Faculty Advisor: Dr. Dmitry Kurouski

Elucidating the Molecular Mechanisms of Tau Aggregation and their Role in Alzheimer's Disease

Alzheimer's disease (AD) and other neurodegenerative diseases are characterized by the intracellular aggregation of the microtubule-associated protein tau. While the presence of large, insoluble neurofibrillary tangles (NFTs) has long been the primary focus of this research, a paradigm shift in the field now highlights smaller, soluble oligomers as the more neurotoxic tau species leading to neuronal death and cognitive decline. This leaves the important and ill-understood question of what molecular events lead to the initial conversion of healthy, functional tau into these toxic oligomers. This project addresses this knowledge gap by investigating existing literature on the upstream mechanisms responsible for the onset of neurodegeneration. By synthesizing evidence from molecular biophysics, cellular biology, and neuropathology, this research builds a holistic narrative of tau aggregation that bridges the gaps between existing research. This analysis focuses on the properties of tau and its isoforms alongside the events influencing its aggregation, including post-translational modifications such as hyperphosphorylation and ubiquitination as well as environmental factors like membrane lipid content. By connecting these factors with findings from human brain studies, this project establishes a comprehensive timeline of pathology that identifies the transition from physiological tau to toxic oligomers and links specific molecular triggers to the onset of neurodegeneration. This will lay a framework for future studies and the development of therapeutic strategies to target AD and other tauopathies.

Oral Session 3: 12:15 PM-1:30 PM CT
Room: MSC 2300 D

Presenter #3: *Arthur L. Mayo*

Major: Neuroscience

Faculty Advisor: Dr. Jeff R. Jones

How the Diurnal SCN Creates Reliable Daily Rhythms

The suprachiasmatic nucleus (SCN) is the central pacemaker of the brain and is responsible for the coordination of daily rhythmic behaviors such as sleeping, eating, and exercising. We are investigating how the SCN operates in a diurnal species, since most mechanistic circadian work has been conducted in nocturnal rodents and the circuitry supporting rhythm stability in diurnal systems is largely unknown. We hypothesize that AVP- and VIP-expressing neuronal subregions contribute to rhythm stability in the diurnal SCN through mechanisms that differ from those described in nocturnal models. To test this, we generated ex-vivo SCN slices from diurnal striped mice and expressed a bioluminescent PER2-luciferase reporter to measure baseline molecular rhythms. These recordings showed that the diurnal SCN expresses robust daily oscillations that are similar to, but distinct from, those found in nocturnal species. Next, we validated AVP-cre viral specificity through immunohistochemistry, then applied a Cre-lox viral strategy to restrict the reporter to AVP neurons in the striped mouse SCN to isolate their individual contributions to rhythmicity. After recording molecular rhythms from these subregions, we plan to selectively disrupt AVP circuits and then measure whole SCN rhythms to quantify how the subregion supports rhythm stability. This work will define how key SCN subcircuits function in a diurnal species and improve the alignment between rodent models and human circadian physiology.

Oral Session 3: 12:15 PM-1:30 PM CT
Room: MSC 2300 D

Presenter #4: *Alyssa Kubesch*

Major: Microbiology

Faculty Advisors: Dr. Suresh Pillai, Dr. Chandni Praveen

Electron Beam Processing of Chewing Tobacco to Reduce the Potential for Cancer-Causing Nitrosamine Formation

Microbial populations present in smokeless tobacco products have been implicated in the formation of tobacco-specific nitrosamines, carcinogenic compounds associated with oral cancer risk. Certain bacterial populations involved in nitrate metabolism can convert plant-derived nitrates to nitrites, which may subsequently react with tobacco alkaloids to form nitrosamines. Therefore, technologies capable of reducing or eliminating these microbial populations may decrease the potential for nitrosamine formation in tobacco products. The underlying hypothesis of this study was that energetic electrons generated during electron beam treatment would effectively inactivate microbial populations present in chewing tobacco. The specific objective of this work was to quantify baseline microbial loads in commercially available chewing tobacco products and to identify electron beam doses capable of eliminating viable microorganisms. Three commercial chewing tobacco brands were evaluated in long cut, fine cut, and pouch product forms. Baseline analysis revealed diverse microbial populations dominated by facultative anaerobic Bacillus species. Untreated samples were analyzed in triplicate to determine baseline microbial concentrations. Samples from one brand were subsequently treated with eBeam at doses of 2, 5, and 8 kGy, and surviving populations were quantified using standard plate count methods. Commercially sold samples exhibited high microbial loads, with mean concentrations ranging from approximately 5.4 to 5.8 log CFU per gram across product types. Electron beam treatment resulted in a clear dose-dependent reduction in microbial populations. At 2 kGy, reductions ranged from approximately 0.7 to 1.8 log CFU per gram, while 5 kGy produced reductions of approximately 2.0 to 2.6 log CFU per gram. No viable microorganisms were detected at 8 kGy. These findings indicate that electron beam treatment is an effective method for reducing microbial populations, including nitrite-forming Bacillus species. Ongoing work focuses on deeper microbial community characterization and evaluation of the relationship between microbial reduction and nitrosamine formation.

Oral Session 4
1:45 PM-3:00 PM CT
Room B

Oral Session 4: 1:45 PM-3:00 PM CT

Room: MSC 2300 B

Presenter #1: *Abdoulaye Diop*

Major: Electrical Engineering

Faculty Advisors: Dr. Jonathan Snodgrass, Dr. Wonhyeok Jang

Linear Program for EV Charging Station Siting with K-means L1 Norm Activation Penalty

Public Electric Vehicle charging stations must expand quickly while avoiding stressing electric distribution feeders. This paper proposes a feeder-aware linear program (LP) that enforces Kirchhoff's Current Law (KCL) on a radial feeder graph, and caps flows by per-edge load hosting capacity (LHC) or thermal limit. Sparse, interpretable site sets are induced using an L1 norm inspired activation penalty that enforces proximity by biasing sites' activation toward multi-family housing (MFH) demand locations via node-specific penalties derived from MFH proximity and k-means distances. The model is convex, solver-agnostic, and implemented in Julia (JuMP) with HiGHS solver. Using reputable distribution feeders' data, we demonstrate that the LP selects best tap-in nodes from which MFHs can connect EV chargers while respecting feeder capacities. Relative to nonconvex, multi-objective, or two-stage formulations, our approach is fast, reproducible, and extensible: it can be re-run as a screening layer across dozens of feeders and adapted to other types of load placement projects without changing the model class.

Oral Session 4: 1:45 PM-3:00 PM CT
Room: MSC 2300 B

Presenter #2: *Ian Wilhite*

Major: Interdisciplinary Engineering

Faculty Advisor: Dr. Jason O'Kane

Reinforcement Learning-based Hybrid Controller for Autonomous Underwater Vehicles

Autonomous Underwater Vehicles (AUVs) face planning and control challenges due to dynamic currents, sensor noise, and limited communication. Existing approaches rely on either global path planners that generate waypoint trajectories without mitigating position estimation drift, or analytical methods such as Model Predictive Control (MPC) and Linear Quadratic Regulation (LQR) that falter under large uncertainties. This thesis addresses the gap between high-level planning and low-level actuation by developing a reinforcement learning-based controller for flipper-driven AUVs. The work presents two primary contributions: first, a physics simulator calibrated using field datasets that enables reproducible evaluation of control strategies; and second, a reinforcement learning controller to translate waypoint-based trajectories into action policies capable of handling environmental uncertainties. Preliminary results show that the PINN-tuned simulator parameters demonstrate reduced trajectory tracking error and lower accumulated drift from the baseline physical simulation parameters. This work advances sim-to-real transfer methodologies in marine robotics provides a generalizable framework for mid-level control that extends mission duration and enables effective operation in challenging underwater environments where traditional control approaches fail.

Oral Session 4: 1:45 PM-3:00 PM CT
Room: MSC 2300 B

Presenter #3: *Madeleine Lerma*

Major: Zoology

Faculty Advisor: Dr. Sarah Hu

The Ecology of Early Microbial Eukaryotic Settlers at Deep-Sea Hydrothermal Vents

Deep-sea hydrothermal vents host diverse and understudied microbial communities that form the foundation of a food web without sunlight. Primary production is provided by chemosynthetic prokaryotes, which are consumed by secondary microbial communities, including microbial eukaryotes or protists. These protists feed on or form symbiotic relationships with many of the bacteria and archaea. Deep-sea hydrothermal vent ecosystems also host a diverse community of settled, benthos-associated species such as tubeworms, mussels, and crabs. Yet, the ecological factors that promote the settlement of larger fauna at vent systems are not well understood. In this study, we investigated the potential role that microeukaryotes play in early-stage colonization. Six colonization incubation experiments were deployed near a hydrothermal vent along the Gorda Ridge. Each device contained a temperature logger and three substrate types: quartz, Riftia tube, and shell material. Microcolonizers were recovered after 6, 7, and 8 days of deployment to capture the initial colonization of microeukaryotes on different substrate types. RNA was extracted from the substrate surface, converted to cDNA, and the V4 hypervariable region within the 18S rRNA gene was amplified and sequenced. Protist assemblages were dominated by a subset of supergroups and phyla, including ciliates, stramenopiles, and amoebozoa, with variation observed among substrates and across deployment time. Differences in relative sequence abundance and amplicon sequence variant (ASV) richness suggest that time and substrate type influence early colonization. The results provide insight into the establishment of microbial eukaryotes at hydrothermal vents and highlight the role of environmental heterogeneity in shaping early community structure. Studying early microbial colonization has broader implications for ecosystem development, functioning, and resilience.

Oral Session 4: 1:45 PM-3:00 PM CT
Room: MSC 2300 B

Presenter #4: *Aarya Newasekar*

Majors: Anthropology, Classics

Faculty Advisor: Dr. Constantine Karathanasis

Licensed and Limited: Humor in Attic Old Comedy and Classical Sanskrit Drama

Humor, particularly of the satirical kind, is a key feature shared by both Attic Old Comedy and Classical Sanskrit drama. Attic Old Comedy, produced in Athens during the late fifth and early fourth centuries BCE, made use of clever wordplay, obscenity, slapstick humor, and ruthless, timely socio-political satire. On the other hand, Classical Sanskrit drama, produced in the Indian subcontinent likely between 200 BCE and 650 CE, consisted of an assortment of genres, humor largely derived from incongruity, and a more subdued satire of social vices and abuses of power. Although it might be tempting to attribute the differences in the kind of humor used in both dramatic traditions to the differences in the political structures of Athens and Ancient India at the time the plays were produced, this paper argues that they are better explained by an interplay of license and limitation within which Athenian and Sanskrit dramatists worked. It demonstrates that Attic Old Comedy and Classical Sanskrit drama derived their license to speak from different institutions — Athenian democracy and the religio-cultural systems of Ancient India, respectively — which placed on them corresponding limitations. These limitations were not necessarily always enforced through legal or official means but often via convention, and discouraged the undermining of the license-granting institutions through ridicule. A comparative study of the kind of humor used in Attic Old Comedy and Classical Sanskrit drama, and of the political and socio-cultural systems that shaped it, reveals that in navigating systems of license and limits, dramatic humor was shaped by factors more complex than the presence or absence of some abstract notion of free speech.

Oral Session 4
1:45 PM-3:00 PM CT
Room D

Oral Session 4: 1:45 PM-3:00 PM CT

Room: MSC 2300 D

Presenter #1: *Juan Lleras*

Majors: Philosophy, Psychology

Faculty Advisor: Dr. Glen Miller

The Value of Friendship in a Contemporary Good Life: What Aristotle and Psychology Can Teach Us About the Types of Relationships We Should Be Making Today and What We Owe Them

Over the last 20 years, reported feelings of loneliness have increased across the Western world. Specifically, since the last century, there has been a significant drop in number of reported close friendships among Americans. Meanwhile, other types of relationships have remained relatively steady. Seemingly, modern Western society has placed a higher value on romantic relationships, work relationships, and family roles over conventional friendships. This is a shame, and a large part of this problem might be the ambiguity around the whole role of friendship today. Specifically, the lack of clear scripts or expectations for how we should treat our friends, what we owe them, who our "real" friends are, or their role in our lives. As such, turning to philosophy, an area where friendship has been a topic of inquiry for a long time, might help clarify the nature of friendships in our lives. Aristotle, specifically, provides a framework with which we can examine the topic and the idea of a good life. For Aristotle, the good life was a life of constantly striving for virtue and avoiding vices to achieve human flourishing. My research will take an Aristotelian perspective to clarify the vital role of friendship in a contemporary good life. Specifically, I develop three kinds of obligations that virtuous friends have towards each other. There are obligations related to moral growth, which is the element of friendship by which friends encourage each other toward virtue and away from vice. Another kind of obligation depends on empathy, which represents the element of virtuoso friendship where two friends show genuine intimacy towards one another. A third kind of obligation is related to self-knowledge; this represents the element of virtuous friendship, which allows both friends to seek "the life of contemplation" together by understanding themselves on a deeper level through directing and interpreting each other. Each of these obligations show how we can achieve the good life today through our friends.

Oral Session 4: 1:45 PM-3:00 PM CT
Room: MSC 2300 D

Presenter #2: *John Vick*

Major: Psychology

Faculty Advisor: Dr. Rebecca Schlegel

The Self Under Review: Testing the State and Trait-Consistency Hypothesis Using Guilt and Shame

From moment to moment, people behave in ways that align, and in ways that do not align their dispositional traits. Instead of using personality traits, we will compare the trait consistency and state-content significance hypotheses using dispositional proneness to two self-conscious emotions. The trait-consistency hypothesis argues that people will feel more authentic when their personality states are congruent to their dispositional personality traits (Fleeson & Wilt, 2010). Contrarily, the state-content hypothesis argues that regardless of traits, some ways of acting feel more authentic because of their content and consequences (Fleeson & Wilt, 2010). In a between subjects design, participants (N = 307) were randomly assigned into two conditions, one for shame and one for guilt. Utilizing a novel version of a shame and guilt guided imagery emotion elicitation to induce feelings of shame or guilt, post-manipulation subjective authenticity levels showed support for the state-content significance hypothesis across both conditions. In other words, higher levels of state shame and state guilt were associated with lower levels of post-hoc state authenticity, regardless of their respective trait levels. We did not see support of the trait-consistency hypothesis in either the shame condition or the guilt condition. However, the manipulations failed to properly elicit shame and guilt; evident by the guilt condition having overall higher state shame and guilt means relative to the shame condition. Exploratory analyses were conducted to further explore these initial relationships. Possible implications of the data, the efficacy of the manipulation, and more will be explored in the discussion.

Oral Session 4: 1:45 PM-3:00 PM CT
Room: MSC 2300 D

Presenter #3: *Emily Johnson*

Major: Philosophy

Faculty Advisor: Dr. David Koepsell

Hobbes and Locke: How a Liberal Society Transforms into Authoritarianism

This thesis examines how liberal political societies grounded in Lockean principles transform into authoritarian regimes resembling Hobbesian ideals. The project will draw on the political philosophies of John Locke and Thomas Hobbes in order to analyze historical cases such as the Roman Republic, the English Civil War, and the collapse of the Weimar Republic. These political philosophies will identify recurring patterns which reveal how liberal governments fall into authoritarianism during times of social, economic, and political crises. Central to this analysis is the role of political pluralism, or the view that political power should be dispersed among competing groups which is a defining feature of democratic societies. While pluralism allows for diversity through competing ideologies it can also contribute to instability when institutional trust is lost and consensus becomes unattainable. I argue that during times of crisis, pluralism shifts from a stabilizing ideal to a source of institutional fragmentation, encouraging an appeal for an absolute sovereign to provide order and security. Through a combination of philosophical and historical analysis, this thesis will explain why societies characterized by pluralism may ultimately gravitate towards authoritarianism, as well as highlight the persistent relevance of Hobbes and Locke's theories for understanding the vulnerabilities of modern democracies.

Oral Session 4: 1:45 PM-3:00 PM CT
Room: MSC 2300 D

Presenter #4: *Diana Nguyen*

Major: Economics

Faculty Advisors: Dr. Chelsea Strickland, Dr. Margaret Ray

The Relationship between Abortion Access and Female Labor Force

In June 2022, the U.S. Supreme Court overturned Roe v. Wade, leading the political landscape concerning abortion access to be further divided and fragmented; more than half of the fifty states restricted abortion within their state territory. The policy change provides the framework to examine whether the deliberalization of state abortion laws affects states' female labor force supply. I use an Ordinary Least Squares (OLS) regression to run on state cross-sectional data in the year 2023, with the dependent variable being the female labor force participation rate and the variable of interest– a binary variable indicating the restrictive nature of the state's abortion policies. Understanding the relationship between abortion access and female labor force participation rate may help inform policy decision-making and improve the welfare of females.

Oral Session 5
3:15 PM-4:30 PM CT
Room B

Oral Session 5: 3:15 PM-4:30 PM CT

Room: MSC 2300 B

Presenter #1: *Kareem Kabbani, Jyoshitha Madhavarapu, Rebecca Chen, Yuhan Zheng*

Major: Computer Science, **Major:** Computer Science,
Major: Computer Engineering, **Major:** Electrical Engineering

Faculty Advisor: Dr. Yang Shen

An Agent-Based AI Framework for Predicting and Explaining Protein Mutation Effects

Current computational predictors of mutation effects are often limited to a single protein sequence input and produce a single output for a specific mutation effect, without considering the diverse biological contexts that impact both, such as molecular and cellular structures and interactions. This leads to the lack of accuracy and explainability in predictions. Meanwhile, these computational methods are often difficult for target users, including clinical decision-makers and researchers, to access. This gap between model predictions and clinical testing makes it difficult to interpret and apply the findings effectively. Thus, we developed an integrated agent-based system that streamlines the prediction, reasoning, and communication of protein mutation effects and enhances the model's biological contexts by including both molecular and cellular structures and interactions. The system is composed of four major components: 1. Multimodal and multitask machine learning models that enrich contexts for both proteins and mutation effects; 2. An agentic chatbot that provides a conversational interface between users and models and retrieves explanations from a knowledge base, leveraging pretrained, general-purpose large language models (LLMs); 3. Finetuned and tailored protein LLMs, enhanced through instruction tuning on curated datasets covering sequence, structure, function, interaction, and mutation effects; 4. A cloud-based web application that allows clinical users to seamlessly access, visualize, and interact with predictions, explanations, and the chatbot. The results are not yet complete; however, we expect to see improvements in users' ability to interact with the machine learning models, enhanced interpretability of the models' results based on the level of depth the user desires, and increased accuracy of the models' predictions. Overall, this provides users with an application that easily answers questions about the effects of protein mutations and interprets findings in a simple, clear manner, thereby reducing the gap between computational models and biological insights and facilitating clinical decision-making.

Oral Session 5: 3:15 PM-4:30 PM CT
Room B

Presenter #2: *Ekaterina Buchilina*

Major: Chemical Engineering

Faculty Advisor: Dr. Efstratios Pistikopoulos

GlobalEdTech: A Dual-Track Software Platform for English Learning and Engineering Technical Training Delivery

As engineering industries continue to expand globally, companies increasingly face challenges in delivering effective technical training to international clients due to language barriers, logistical constraints, and the high cost of in-person instruction. This project proposes the design and development of GlobalEdTech, a dual-track software platform that integrates English language learning with interactive technical training to support scalable, accessible knowledge transfer in engineering contexts. The primary objective of this research is to explore how an integrated digital platform can enhance the delivery of specialized engineering training while simultaneously supporting English language acquisition for non-native speakers. The platform is designed to serve two key user groups: engineering companies seeking to teach clients about their proprietary technologies, and international learners requiring both technical understanding and language support. The system will allow companies to upload training materials and transform them into interactive learning units, simulations, and live instructional sessions, while learners engage with structured English lessons embedded within technical content. Methodologically, this project employs an iterative design framework informed by educational technology and human-computer interaction research. A functional prototype will be developed from scratch, encompassing front-end interface design, back-end architecture, and data management. Usability testing will be conducted with human participants under IRB approval to evaluate clarity, accessibility, and engagement. User feedback will be qualitatively analyzed to guide refinements. The expected outcomes of this project include a working software prototype, a usability evaluation report, and a capstone thesis documenting the research process and findings. More broadly, this work contributes to ongoing discussions in digital learning and engineering education by proposing a scalable alternative to traditional, travel-dependent training models and by addressing the intersection of language learning and technical knowledge transfer.

Oral Session 5: 3:15 PM-4:30 PM CT
Room B

Presenter #3: *Aden Zebaida*

Major: Physics

Faculty Advisor: Dr. Alexei Sokolov

Generating 2-ps Pulsed Squeezed Light at 1032 nm for SRS Microscopy

Stimulated Raman Scattering (SRS) Microscopy is a powerful label-free technique for studying biological samples with molecular-level specificity. However, SRS experiments are often limited by shot noise, resulting in characteristically low signal-to-noise ratios (SNRs). One solution is to exploit the nonlinear properties of SRS by increasing the intensity of input beams, but intense light can degrade biological samples, so such methods are unsuitable for many applications. Another solution targets the source of shot noise itself, i.e. inconsistency in the arrival time of discrete photons. Through the integration of a quadrature-squeezed light source, the effective uncertainty in photon arrival time can be reduced, enabling enhanced SNRs. The literature shows the effectiveness of squeezed light in continuous-wave experiments, with documentation of up to 16 dB of squeezing. However, squeezing factors of only a few dB have been demonstrated for pulsed sources. To take full advantage of the nonlinear nature of SRS, high-intensity pulsed sources, capable of maintaining time-averaged intensities within damage thresholds, are ideal. We are developing a pulsed squeezed-light source for SRS microscopy, seeking 10 dB of squeezing. Current work is aimed toward fine-tuning conditions for generating squeezed light through spontaneous parametric down conversion. Various OPA crystals have been tested for peak performance, and piezoelectric feedback loops are being implemented to optimize alignment and local oscillator calibration. Once squeezing has been optimized, the light source will be fully integrated into a microscopy system, and select samples will be imaged for validation.

Oral Session 5: 3:15 PM-4:30 PM CT
Room B

Presenter #4: *Wenzhe Xu*

Majors: Physics, Electrical Engineering

Faculty Advisor: Dr. Arya Menon

60 GHz Intelligent Radar Platform for Spectrum Coexistence Applications

This project focuses on building a 60 GHz software-defined radar platform aimed at spectrum coexistence with other users, especially communication systems operating in the unlicensed V-band. With growing congestion in the 60 GHz band, there's a critical need for radar systems that can dynamically adapt and coexist with primary users like IEEE 802.11ay. Using off-the-shelf mmWave and computing hardware, the proposed platform will collect real-world spectrum data, which will then be used to train edge-deployable machine learning models. These models will enable real-time opportunistic transmission while avoiding interference with coexisting systems. The hardware setup features a Software Defined Radio with FPGAs and off-the-shelf I/Q transceivers and signal chain calibration tools. The work includes RF front-end calibration, waveform characterization, and machine learning model evaluation and training.

Oral Session 5
3:15 PM-4:30 PM CT
Room D

Oral Session 5: 3:15 PM-4:30 PM CT

Room: MSC 2300 D

Presenter #1: *Catherine Chaison*

Majors: Genetics, Physics

Faculty Advisor: Dr. Claudio Casola

De Novo Gene Evolution and Retention in Mammals

Understanding the origin of new genes is a primary goal of evolutionary biology, with de novo gene birth being one particular process by which this occurs. This mechanism of gene formation is driven by specific mutations that transform originally non-genic DNA into transcribed sequences that encode for proteins and have a biological function. It has been hypothesized that the novel proteins formed by these genes are likely to be functionally disruptive, either through toxic aggregation or interference with existing cellular networks, and therefore should be deleterious and subject to purifying selection that limits their prevalence in genomes. Alternatively, some de novo genes (DNGs) may provide adaptive benefits, facilitating their fixation in genomes and supporting how hundreds of these genes are found across species they are currently characterized in. A problem arises in studying these trends as DNGs are time and computationally intensive to identify, causing their study to be limited to a few model organisms and species of note. This study utilizes a mammalian dataset to find and characterize DNGs across species alongside the development of the LINGUA, LINeage-Specific Gene Universal Annotator, bioinformatics pipeline to facilitate DNG identification on large scales. Implementing stringent criteria for DNG identification allows us to distinguish previously unannotated DNG candidates across a broad range of species and explain the context and evolutionary dynamics of DNG formation and fixation.

Oral Session 5: 3:15 PM-4:30 PM CT
Room D

Presenter #2: *Samhitha Mada*

Major: Psychology

Faculty Advisors: Dr. Samba Reddy, Dr. Ursula Winzer-Serhan

Hippocampal Alpha7 nAChR Modulation of Neuroinflammation Following a Traumatic Brain Injury

Traumatic brain injury (TBI) is a leading cause of chronic neurological disability, with secondary neuroinflammation contributing significantly to cognitive decline and long-term impairment. While current TBI research often focuses on cortical regions or whole-brain effects, hippocampal inflammation remains understudied despite its direct links to cognitive decline and post-traumatic epilepsy. This study investigated the extent of hippocampal neuroinflammation one week post-injury and evaluated the anti-inflammatory efficacy of PNU-120596 (PNU), an α7 nicotinic acetylcholine receptor (nAChR)-specific positive allosteric modulator (PAM). The α7 nAChR plays a crucial role in the cholinergic anti-inflammatory pathway, modulating the expression of inflammatory cytokines and chemokines. Using a controlled cortical impact (CCI) model of severe TBI that induces post-traumatic epilepsy, we examined how hippocampal α7 nAChR activation affects neuroinflammatory responses. Male and female mice received either PNU-120596 or vehicle treatment following CCI, and hippocampal tissue was collected one week post-injury for molecular analysis. We assessed the expression of inflammatory cytokines, chemokines, and glial cell markers using RT-qPCR. We hypothesized that α7 nAChR activation would attenuate these inflammatory responses. Our findings will determine whether PNU-120596-mediated α7 nAChR activation can mitigate hippocampal neuroinflammation following TBI. These results may provide critical insight into potential therapeutic strategies for preventing the cognitive and epileptic sequelae of traumatic brain injury by targeting the cholinergic anti-inflammatory pathway.

Oral Session 5: 3:15 PM-4:30 PM CT
Room D

Presenter #3: *Abigail Billingsley*

Major: English

Faculty Advisor: Dr. Curry Kennedy

The Commodification of the Crucifix

Depicting Jesus' death on the cross, the crucifix is one of the most recognized symbols of Christianity. Jesus' sacrifice is the cornerstone of the religion, so the crucifix is highly regarded, especially within the Catholic church. Adorning churches with artistic representations of God (like the crucifix) has been hotly debated since the Protestant Reformation. During that time, iconoclasts believed symbols and works of art would be worshipped instead of God Himself. Philosophers like Theodor Adorno, Jean Baudrillard, and Graham Howes all discuss the triviality of the world's logos and symbols because an entire concept cannot be fully represented by a simple image. How can a fleeting symbol represent an omnipotent, omniscient, and omnipresent God? Adorno, Baudrillard, and Howes have made their opinions on the crucifix clear- symbols like the crucifix do not have much meaning, if any. What has fictional literature historically said about the crucifix and, by association, Christianity as a religion? This study seeks to investigate society's historical views of the crucifix via three pieces of literature from each era: the Protestant Reformation, the Victorian Era, and the 21st century. Comparing the results of the investigation to the opinions of Adorno, Baudrillard, and Howes, how do society's views align with the philosophers' views of the crucifix? How does the current culture of mass consumerism affect society's view of the crucifix? Because there are more crucifix pieces available for sale than ever before, does high volume impact the crucifix's value? Did the crucifix ever have any value to begin with?

Oral Session 5: 3:15 PM-4:30 PM CT
Room D

Presenter #4: *Kenzie Laird*

Majors: Genetics, Zoology

Faculty Advisor: Dr. Heath Blackmon

Discrete Traits and Hybridization

Understanding how traits evolve is central to the study of evolutionary biology. Discrete traits play a key role in how we interpret the adaptive history of organisms. Phylogenetic comparative methods (PCMs) have become standard tools for studying the evolution of such traits, enabling researchers to estimate ancestral states, compare evolutionary rates, and test models of trait change. However, these methods often assume that species relationships can be accurately captured by a bifurcating tree and that the evolutionary process follows that topology. This assumption becomes problematic in the presence of hybridization. When two species hybridize, alleles can introgress from one lineage into another, creating a mosaic genome that reflects a history of both vertical descent and horizontal exchange. These introgressed alleles can affect fitness and trait expression, potentially altering the evolutionary dynamics of traits in ways not accounted for by standard phylogenetic models. This project investigates how historical hybridization impacts the accuracy and robustness of phylogenetic inferences about discrete trait evolution. By comparing results across different hybridization scenarios, this work will quantify how introgression influences key evolutionary inferences, including ancestral state reconstruction, rate estimation, and model selection. These insights are critical for researchers using PCMs in taxa with complex evolutionary histories, as they highlight the potential pitfalls of ignoring reticulate evolution.

Poster Presentations

Poster Session 1
9:30 AM-10:30 AM CT
Room C

Poster Session 1: 9:30 AM-10:30 AM CT

Room: MSC 2300 C

Poster #1: *Aditya Vontlin*

Major: Computer Science

Faculty Advisor: Dr. Abdullah Muzahid

Entropy Indexing for Branch Prediction

Traditional branch prediction schemes, such as Gshare, use static hashing functions typically involving the Branch IP address to index into a table of saturating counters. While generally effective, static hashing schemes could be more susceptible to aliasing. This paper examines the viability for using a dynamic indexing scheme, based on the entropy of each Branch IP bit to index into a table of saturating counters, based on Entropy Indexing for cache management. In cache indexing, entropy-based selection is highly successful because it identifies which address bits are most likely to toggle, effectively bypassing static address bits to maximize set utilization and minimize conflict aliasing. I adapt this technique to branch prediction by evaluating if real time analysis of bit entropy can improve branch prediction performance. By tracking the correlation of certain branch address bits to branch outcomes, my approach gives an 'entropy score' to each bit in a branching instruction's IP address. The bits with the highest entropy are selected and used to be used for indexing, and its performance is evaluated in the Champsim hardware simulator, against several SPEC benchmark traces. My study assesses the viability of entropy-driven indexing, determining if the benefits observed in cache management can apply to branch direction prediction.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #2: *Jaden Wang*

Major: Computer Science

Faculty Advisor: Dr. Yi Zhou

Advancements in Business Applications of Large Language Models

Large Language Models (LLMs) have rapidly emerged as transformative tools for Natural Language Processing (NLP), with a growing relevance in business applications. This research explores the practical and organizational impact of LLMs by combining theoretical analysis with the development of an applied prototype. This prototype leverages LLM-based text summarization to generate high-quality summaries of business meeting transcripts with the goal to reduce information loss across teams and standardize company note-taking practices to enhance knowledge-sharing. In addition, the development of the prototype reveals key current business challenges in LLM design and training. The model used was Flan T5 Large, trained on transcripts generated to be approximately 30 minutes long and iterated over until all core transcript points were captured. This research also investigates the core principles and architectures underlying modern LLMs. Foundational concepts such as the transformer architecture, attention mechanisms, and pre-training methods are examined alongside model families including GPT autoregressive models, BERT bidirectional encoders, and PaLM transformer-based systems. The study also reviews recent advances in LLM development, including algorithmic improvements, compression techniques, and efficiency-focused optimizations. Further research will assess the broader role of Deep Learning in NLP business tasks while also considering the ethical and computational challenges of scaling LLMs, such as resource intensity, bias, and responsible deployment. By integrating researched insights with a business use case, this project aims to provide a balanced perspective on how LLMs can be effectively and responsibly adopted in modern organizations.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #3: *Sanjay G. Patel*

Major: Electrical Engineering

Faculty Advisor: Dr. Arya Menon

Simulating the Micro-Doppler Radar Signature of UAVs for Machine Learning-Based Classification

Small unmanned aerial vehicles (UAVs), more commonly known as drones, have become increasingly popular in hobbyist, commercial, and defense applications. Their ability to carry payloads and sensors has added to their usefulness but also creates novel safety, security, and privacy concerns. Detecting and classifying UAVs operating in unauthorized areas is critical to mitigate those concerns. Radar sensors have been shown to effectively detect and classify UAVs using a phenomenon known as micro-Doppler, which captures unique signatures generated by the rotational motion of a UAV's propellers. This micro-Doppler signature is commonly analyzed using machine learning (ML) models, but current models are limited by the quantity and quality of data available for training. Existing training workflows involve collecting data through measurements, which is time-consuming, hard to repeat, and cost prohibitive. This work will determine the feasibility of 3D CAD-based tools, specifically Ansys HFSS, for generating synthetic micro-Doppler data of UAVs at the scale necessary to train ML models. The electromagnetic simulation software Ansys HFSS is chosen for its native support of 3D CAD files, ability to parameterize motion, and ease of developing complex simulation environments. Simulations are pre- and post-processed using MATLAB scripts which interact directly with the simulation environment. Using this workflow, the signature of various UAV models will be captured in different environments with different types of radar systems. Additionally, the tradeoff between simulation accuracy and runtime as well as key micro-Doppler features of various UAVs will be explored. This work will allow for future exploration of novel UAV designs, environments, and radar systems to mitigate the risks posed by hostile UAVs.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #4: *Ashwin Parameswaran*

Major: Computer Science

Faculty Advisor: Dr. Tracy Hammond

Attention Mechanism Integration for High Efficiency Medical Image Segmentation

This project focuses on improving the accuracy and efficiency of deep learning models for medical image segmentation, with a specific focus on polyp detection in colonoscopy datasets. While current models achieve strong results, many require long training times and high computational cost. This limits their deployment in real clinical settings. The approach combines modules from recent architectures, including edge-guided attention (MEGANet), self-calibrated convolution (SCNet), and transformer-based backbones like Swin and EfficientNet. Variants were tested with different activation functions, skip connections, and loss functions. Across five benchmark datasets including: Kvasir-SEG, CVC-ClinicDB, CVC-ColonDB, ETIS-LaribPolypDB, and CVC-300: over 20 model versions were evaluated using Dice, IoU, boundary accuracy, and training efficiency. The goal is to identify modular configurations that balance performance with reduced resource demand. This work supports the development of more practical segmentation models for use in medical AI workflows.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #5: *Michael Villard, Jackson Pate*

Major: Electrical Engineering, **Major:** Electrical Engineering

Faculty Advisor: Dr. Aydin Karsilayan

A Monolithic 5.8 GHz Phased Array Transmitter RFIC in 40nm CMOS for Steerable Far-Field Wireless Power Transfer

Radiative far-field wireless power transfer (WPT) using dynamic beamforming has emerged as a promising technique for delivering energy over distance using conventional radio frequency (RF) signals. This thesis presents a monolithic 5.8 GHz phased array transmitter design in TSMC 40 nm CMOS process for dynamically delivering power to mobile devices that are in use and in motion. By addressing the limitations of discrete implementations including, interconnect parasitics, phase drift, and PVT sensitivity, this work proposes a fully integrated architecture on a single chip to ensure beam coherence for precise target tracking and efficient power density delivery. The transmitter RFIC design drives a 64-element planar microstrip phased array. The integrated chip (IC) is comprised of three core subsystems which are a PLL for frequency synthetization generating quadrature outputs from a 32 MHz reference signal, a 5-bit vector sum phase interpolator (VSPI) providing a resolution of 11.25°, and an efficient switching Class-E power amplifier (PA). To mitigate capacitive loading effects on the phase linearity, a pre driver chain will be designed to isolate the VSPI and the PA. The scope of this work is intended to be tape-out-ready, from initial design, through schematic design, layout, post-layout extraction, and system-level verification in Cadence Virtuoso and Spectre. Critical technical challenges included achieving low phase noise in an inductorless VCO, sustaining phase precision under PVT variations, and meeting device reliability constraints in 40 nm CMOS under Class-E switching stress using a cascode topology to manage terminal voltages. Initial simulations demonstrate generation of a 5.9 GHz signal with a lock-in time of 3.3 u secs at 400 mV with a phase resolution of 11.25° (>5° RMS) providing 140 mW output power with a 60% drain efficiency. The resulting thesis establishes an integrated RFIC foundational design for high-efficiency, adaptive beamforming WPT systems.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #6: *Chase Grochett*

Major: Electrical Engineering

Faculty Advisor: Dr. Jeyavijayan "JV" Rajendran

FPGAFuzz: A Generalized FPGA Framework for Hardware Fuzzing

Modern processors and hardware systems have grown in complexity and functionality which poses major challenges to leading hardware verification tools and has led to a sharp increase in hardware vulnerabilities. Methods such as hardware fuzzing, coverage-guided automated test generation, aim to solve this problem. However, the resource overhead for these simulation-based tools leads to increasingly long fuzzing times, decreasing the chance that a security-critical bug may be caught. This work proposes a generalized framework, applicable to most hardware designs and fuzzing platforms, to remove simulation overhead by synthesizing and executing DUTs at native hardware speed on FPGA. Fuzzing points are extracted from industry-standard coverage metrics and are placed in the HDL directly. Two methods are then implemented, allowing a tester to run programs at the highest throughput, or compromise speed for signal tracking propagated from inside the FPGA fabric for comprehensive debugging. Utilizing a FPGA with a PS/PL system allows the synthesized logic to be loaded and managed by a Linux image which has support for common toolchains required by most general hardware fuzzers. Preliminary results show significant speedup as compared to simulation, however optimizing the extracted coverage metrics promises an even greater speedup in achieving total coverage of a system. The combination of optimized coverage metrics and FPGA emulation enables testers to create more rigorous strategies of determining security vulnerabilities before chip production.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #7: *Daniel Choi*

Major: Computer Science

Faculty Advisor: Dr. Roger Pearce

Distributed Coordinate-Format SpGEMM with Message Aggregation in YGM

This paper considers sparse matrix-matrix multiplication (SpGEMM) using the Coordinate (COO) format as the underlying data representation in the computation pipeline. While most existing SpGEMM research focuses on Compressed Sparse Row (CSR) or Compressed Sparse Column (CSC) formats, COO-based SpGEMM has received relatively limited attention. The primary objective of this work is to optimize runtime and memory performance of SpGEMM while systematically analyzing advantages and limitations of utilizing the COO format. The proposed algorithm targets distributed-memory systems, in which minimizing inter-node communicatoin is a critical factor for achieving scalability. Thus, the approach is to dynamically offload computation tasks, specifically multiplication and accumulation of partial products, to remote processors that own the required data, thereby avoiding unnecessary data movement. Furthermore, it incorporates a binary owner-searching technique that enables a processor to efficiently identify multiple processors that own the required data in O(P*log(P)) time while requiring only O(P^2) additional memory. The COO-based SpGEMM is developed using YGM, a distributed-memory, parallel programming library designed for high throughput at the cost of increased latency. YGM minimizes communication overhead through message buffering and aggregation, which reduces the frequency of inter-node communication and amortizes added latency costs across larger message payloads. The SpGEMM algorithm is evaluated through comprehensive weak and strong scaling studies, and its runtime performance is compared against the state-of-the-art GraphBLAS SpGEMM kernels. The results present both the performance potential and the trade-offs of COO-based SpGEMM in distributed environments.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #8: *Karan Bhalla*

Major: Computer Science

Faculty Advisor: Dr. Timothy Davis

Centrality Metrics in GraphBLAS

Centrality metrics measure the relative importance of nodes and edges within a graph, identifying those that are most influential. These metrics provide insight into network structure, helping to pinpoint key nodes that control information flow and play critical roles in connectivity. Traditional implementations of such algorithms are often iterative and don't scale well to large graphs. With GraphBLAS, graph algorithms can be expressed using linear algebra operations on matrices and vectors, allowing computations to be performed in parallel and with greater efficiency. This linear algebra based approach is particularly well-suited for handling sparse graphs. Sparse graphs are networks where edges are very few relative to the total number of possible connections and commonly appear in many real-world scenarios. This paper extends the suite of centrality metrics in SuiteSparse:GraphBLAS by implementing Katz and closeness centrality algorithms. Katz centrality measures a node's influence by considering all paths that connect it to other nodes, giving less weight to longer and indirect connections. Closeness centrality reflects how near a node is to all other nodes in the graph based on the shortest-path distances. We benchmark our implementations to evaluate their performance and compare them against existing centrality algorithms in SuiteSparse:GraphBLAS as well as other graph frameworks.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #9: *Arnoldo Rodriguez II*

Major: Electrical Engineering

Faculty Advisor: Dr. Matthew Johnson

Topology Optimization of Magnetic Gears

This research project focuses on the topology optimization of coaxial magnetic gears (CMGs). CMGs are a type of gear that transmits torque through magnetic fields from an outer rotor to an inner rotor, with a middle rotor as a magnetic medium that connects the outer and inner rotor, rather than using mechanical contact. CMGs offer advantages over traditional mechanical gears, including reduced maintenance, improved reliability, and physical isolation between rotating shafts. These features make them a promising option for some applications, such as wave and wind energy conversion. The goal of this project is to develop, simulate, and fabricate an optimized 2D CMG design that maximizes volumetric torque density (VTD). The process will begin by learning the ANSYS Electronics software to create and analyze a 2D CMG model. We will then use a simpler typology in the creation of a genetic algorithm using MATLAB. This platform was chosen due to the versatility and usage in the Topology Optimization (TO) field such as multiple extensions needed for TO including the partial differential equation library. We will be able to optimize the topology based on the simulation data collected, which will be the Magnetic field of the system. The analysis will be done using finite element analysis (FEA) of the magnetic flux throughout the gear. Using this information, we will be able to simulate using the Texas A&M supercomputer to streamline the analysis of the CMG. The final phase will involve creating a prototype from the optimized CMG and producing a visual demonstration of the topological evolution to present alongside the prototype.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #10: *Emma Webb*

Major: Biochemistry

Faculty Advisor: Dr. Carlos Gonzalez

Spontaneous Plaque Formation in Burkholderia

Burkholderia cepacia complex (Bcc) is a gram-negative opportunistic pathogen that can cause life-threatening, multidrug-resistant infections in patients with cystic fibrosis (CF), for which bacteriophage (phage) therapy is a possible treatment. Only virulent phages are currently considered a viable option for phage therapy, due to their ability to only follow the lytic cycle and kill the bacteria upon infection. However, most naturally occurring Burkholderia phages are temperate, and the few characterized lytic phages have narrow host ranges. Therefore, isolating novel lytic phages is a vital endeavor for phage therapy efforts. Some isolates of Bcc undergo the unusual behavior of autoplaquing, which involves the spontaneous production of phage that results in the formation of plaques on a bacterial lawn. The event varies among single colony isolates from one bacterial strain, with all or some of the single colonies expressing unpredictable phage production. Gaining a better understanding of conditions that favor the unpredictable event may elucidate parameters to induce autoplaque formation. Interestingly, autoplaquing has not been previously reported in members of the Bcc. Based on previous studies of autoplaquing behavior in genera such as Pseudomonas, Neisseria, and Corynebacterium species, the behavior may be linked to a nutrient level response or quorum sensing. Media with varying nutritional contents were tested using several Burkholderia species to determine the effect on autoplaque induction. Plaque formation was assessed using the soft agar overlay method or observed over time via a liquid time-kill assay. One aim of this project is to determine the potential conditions which may induce autoplaquing behavior in isolates of Burkholderia. The next aim is to apply those condition(s) to isolate novel virulent mutant phages that can potentially be used for treatment of Burkholderia infections in patients with cystic fibrosis.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #11: *Azariah Teklu*

Major: Neuroscience

Faculty Advisor: Dr. Hongying Wang

Identifying Ghrelin KO in 5XFAD Mice to Study the Effect of Ghrelin in Alzheimer's Disease via Genotyping

Alzheimer's disease (AD) is a neurodegenerative disease that largely affects the aging population. Genetic risk factors significantly influence AD severity and progression, necessitating precise genotyping approaches to accurately characterize disease-associated phenotypes. In this study, genotyping was utilized to evaluate Alzheimer's-related pathology in Ghrelin knockout (KO)-5XFAD (FG) mouse model, which combines a familial AD background with disruption of the ghrelin signaling pathway. The FG model enables investigation of how genetic modifications contribute to variability in AD symptoms, particularly those associated with cognitive behaviors and neuroinflammatory dysregulation. Genotyping analysis was performed to confirm gene deletions and stratify experimental cohorts prior to phenotypic assessment. Briefly, mouse tail tips were digested to get DNA samples, then polymerase chain reaction (PCR) assay and agarose gel electrophoresis were performed to identify the ghrelin KO and 5XFAD mutant mice, and their wild type controls. These findings demonstrate the utility of genotyping as a foundational tool for linking genetic alterations to AD pathology and support the FG mouse model as a valuable system for studying the effect of ghrelin in Alzheimer's disease progression.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #12: *Aditya Ramakrishna*

Major: Biomedical Engineering

Faculty Advisors: Dr. Jane Welsh, Dr. Candice Brinkmeyer-Langford

Investigating Effects of Theiler's Virus on Neurodegeneration

Neurological disorders such as Parkinson's disease (PD), multiple sclerosis (MS), and amyotrophic lateral sclerosis (ALS) are characterized by neuronal loss, inflammation, and functional decline, yet their etiologies remain unclear. Increasing evidence implicates viral infections as environmental factors, but not all individuals exposed to neurotropic viruses develop disease, suggesting a critical role for host genetic background. Theiler's murine encephalomyelitis virus (TMEV) induces diverse neuropathological outcomes in mice and serves as a model for studying viral-driven neurodegeneration. It was hypothesized that TMEV infection of genetically diverse Collaborative Cross (CC) mice would reveal strain-specific features of viral-induced pathology. Previous research demonstrated that TMEV infection of the substantia nigra pars compacta (SNc) contributes to degeneration of dopaminergic neurons, producing PD-like pathology. Other studies revealed that TMEV can spread through the spinal cord, resulting in demyelination and lesion formation reminiscent of MS. These findings support the use of TMEV as a versatile viral model to investigate neurodegeneration. In this study, five CC mouse strains were infected with TMEV and examined clinically and histologically at 4, 14, and 90 days post-infection (dpi). At 4 dpi, microglial activation (Iba-1 immunopositivity) was greater in the dorsal lumbar spinal cord, whereas by 14 dpi, increased activation was observed in the ventral spinal cord, mainly in strains CC023 and CC078, corresponding to lesion localization. This work demonstrates that genetic diversity influences neurological outcomes of viral infection and highlights TMEV as a versatile viral model for studying neurodegeneration.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #13: *Brianna Villarreal*

Major: Biomedical Sciences

Faculty Advisors: Dr. Ryland Young, Prasanth Manohar

Holin Regulation and Lysis Inhibition in a T4 Like Kuttervirus

Bacteriophages rely on well-timed lysis of their bacterial hosts in order to reproduce and spread. This timing is mainly controlled by proteins called holins, which accumulate in the bacterial membrane and eventually trigger cell lysis by allowing enzymes to degrade the cell wall. While lysis inhibition in bacteriophage T4 is controlled by interactions between holins and antiholins, no comparable regulatory proteins have been identified in this Kuttervirus, leaving its lysis control mechanism unclear. This study focuses on a newly identified T4-like Kuttervirus that infects Salmonella enterica and encodes a Class I holin with three transmembrane domains. During shaker flask experiments, higher phage concentrations led to delayed lysis, suggesting the presence of a lysis-inhibition system, even though no known regulatory proteins have been identified in this phage. To study this further, double agar overlay assays were used to examine plaque morphology under conditions that promote lysis inhibition. Plaques showing differences in size or clarity compared to the wild-type parental phage were isolated as potential mutants. DNA was extracted from selected isolates and sent for whole-genome sequencing, followed by comparison with the wild-type phage genome. Preliminary results indicate mutations affecting the C-terminal region of the holin protein, which suggests that this region may play a role in controlling lysis timing. Overall, this work explores lysis regulation in an understudied phage system and contributes to a better understanding of how Class I holin may function outside the well-characterized T4 model. Learning how different phages regulate lysis helps expand the range of phages that can be safely and effectively used in medical settings against antibiotic resistance.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #14: *Aishu Senthil*

Major: Molecular & Cell Biology

Faculty Advisor: Dr. Xu Peng

Exploring the Role of METTL14-mediated mRNA Methylation in Vascular Inflammation

RNA modifications are an important component of gene regulation that influence cellular function and disease. One such modification, N6-methyladenosine (m6A), plays a key role in controlling mRNA stability and translation. METTL14 is an important component of the m6A “writer” complex responsible for adding this modification on RNA. Previous studies have shown that reduced METTL14 expression leads to decreased m6A methylation and is associated with diminished endothelial inflammation. However, the exact role of METTL14 in inflammatory vascular diseases such as vasculitis remains unclear. In this study, we investigate the function of METTL14 in vasculitis by genetically knocking out mettl14 and examining resulting changes in endothelial cell inflammation. By assessing inflammatory responses in the absence of METTL14, this work aims to clarify how m6A-mediated RNA regulation contributes to vascular inflammation and may identify METTL14 as a potential regulatory factor in vasculitis.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #15: *Gene Felix*

Major: Biomedical Engineering

Faculty Advisor: Dr. Akhilesh K. Gaharwar

Open-source Multi-vat DLP Bioprinter

Light based additive manufacturing (AM) enables the production of a variety of materials such as plastics, elastomers, and bioactive constructs. Digital light processing (DLP) bioprinting is a recent form light based VAM with the capacity to fabricate complex biomimetic structures. Commercially available DLP bioprinters are expensive on the order of >$20,000 and are traditionally limited to single materials. To address this issue, this project details how to construct a multi-vat DLP printer with a total cost of ~$6,000. The base of the DLP printer is built off of a commercial DLP printer, the Anycubic Photon Ultra. Additional parts are listed and purchased to enable modular control of the printer. The design of the printer supports three light sources, 405 nm light (violet), 450 nm light (blue), and 525 nm light (green). Direct control of the DLP projector is provided through an HDMI cord enabling image projection. A custom open source user interface software available on GitHub and developed using Python is provided to connect to the printer. The user interface is capable of STL slicing and supports multi-vat printing and the setting of different exposure times for different models. More features such as variable intensity and automatic wavelength control are planned to be added. Assembly instructions, part availability, and part pricing is provided for full transparency and design adoption.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #16: *Sanjana Venkatesh*

Major: Manufacturing & Mechanical Engineering Technology

Faculty Advisor: Dr. Mathew Kuttolamadom

Design and Investigation of the Durability of Bioinspired Surfaces Made by Additive Manufacturing

Mammalian tooth surfaces depict a unique combination of hardness and toughness, resulting in exceptional durability despite the continued exposure to high mechanical wear and stress. One unique microstructural characteristic that enables this is the alternating regions of high and low elastic moduli near the surface, which results in selective compliance, which in turn reduces stress concentrations and hence wear. This natural design has inspired the growing interest in materials science for applications where wear-resistant and long-lasting surfaces are important. The central question guiding this project is: Can bioinspired surface microstructures modeled after mammalian teeth be effectively replicated using additive manufacturing, and do they enhance durability compared to conventional surfaces? This research is motivated by the need for more efficient and wear-resistant surfaces in sectors such as aerospace, biomedical devices, and engineering surfaces in general. While there have been previous studies exploring bioinspired materials, there has not been a focus on microstructurally graded surface and subsurface properties using high-resolution additive manufacturing techniques. This project distinguishes itself by applying Laser Powder Bed Fusion (LPBF) to fabricate engineered surfaces that mimic the mechanical property distribution shown in teeth, with an emphasis on both the printability of these microstructures and their mechanical performance. This work builds on materials research and recent advances in multi-material or functionally graded additive manufacturing. By integrating biological insights with engineering applications, the project aims to bridge a gap between natural design principles and industrial implementation. The expected outcome is a better understanding of how surface durability is affected because of the selective compliance of sub-surfaces. This project could inform new strategies for surface design across multiple industries, improving performance while reducing material waste and maintenance needs.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #17: *Ella Rydell*

Major: Ecology & Conservation Biology

Faculty Advisor: Dr. Katie Bojakowski

Sustaining Psittacine Research in Aviculture through Digital Preservation of Physical Media

Led by supervising researcher Dr. EV Voltura, The Parrots' Project is a comprehensive, interdisciplinary research initiative exploring topics related to birds in the order Psittaciformes, also known as parrots. The project's focus lies on utilizing both primary and secondary research methods to form a nexus of the ever-growing body of knowledge about parrot cognition, diet, health/disease, and behavior. The outcome of this will have real-world implications in parrot conservation, thereby helping to remedy the direct and indirect negative impacts that dwindling parrot populations have on human well-being. The Parrots' Project contributes to the sustainability of Psittacine aviculture through the compilation of existing physical media regarding parrot research and, accordingly, the restoration, digitization, and preservation of this physical media, thereby preserving knowledge that may have otherwise been lost to time for future aviculturists and establishing a central repository for this body of knowledge. Specifically, the project focuses on digitizing a collection of Avicultural Society of America bulletins, both for the organization's use and for aviculturists and the public. Furthermore, the digitization of this collection will enable exploration of changes over decades in species representation and in information on parrot diet, cognition, health, and behavior. The project addresses the combating of archival bias and technological obsolescence, which contribute to accessibility issues within this field. This poster will present a workflow for collection digitization and preliminary observations on the historical representation of species themes across decades. I will approach the care and management of this collection with its future use by aviculturists and conservation scientists in mind, prioritizing accessibility, organization, and digital longevity. The collection will also require provenance research and its respective recordkeeping.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #18: *Alysa N. Taylor*

Major: English

Faculty Advisor: Dr. Kristine Korzow

Using and Refining ZooMS Sampling Methods in the Case of Ivory Research

Research into human-elephant relationships and the commodification of ivory is fundamentally limited by incomplete or unreliable records, which complicate tracing ivory artifacts to individual animals. While historical records such as hunting logs, photographs, primary-source diary entries, and traced ivory trade routes are available, the limitations of the source material still affect professionals seeking to assess human impacts on elephants or to draw further conclusions about the commercialization of ivory without relying entirely on colonial or commercial documentation. To address this issue, the adoption of an alternative method of gathering data from physical ivory artifacts in a cost-effective and minimally destructive manner is vital. This paper advances the use of Zooarchaeology by Mass Spectrometry (ZooMS) as a viable method to utilize physical ivory products as a useful primary source. Furthermore, this paper aims to improve the process of sampling ivory for optimal data. ZooMS is a collagen-based proteomic technique used to identify the origin species of animal material that is ambiguous in its morphological appearance due to breakage or, often in the case of ivory, changes in form for aesthetic purposes. This study presents an experimental evaluation of abrasive sampling sticks used to collect samples of collagen from ivory surfaces for ZooMS. A controlled comparison of sampling sticks with varying grit levels was conducted to assess the amounts of collagen collection without substantial morphological damage. Results demonstrate that a general shift to higher-grit sampling sticks could improve collagen collection while maintaining the visual integrity of the ivory artifact. Improved sampling methods allow ivory artifacts to support more detailed interpretations of elephant commodification and human impact than the historical record alone. Ongoing replication of this evaluation, including the distribution of standardized sampling kits containing each grit pattern, will further validate this approach.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #19: *Evie C. Liang*

Major: Visualization

Faculty Advisor: Dr. Tianna Helena Uchacz

Searching for Traces of Metalsmithing Techniques in Renaissance Ornament Prints

In the Renaissance, artists produced engravings of ornamental designs that were meant to be useful for their fellow artisans, and many such prints were meant to be useful to goldsmiths. Today, we value these designs for their beauty, but are they more than mere aesthetic exercises? Might they encode technical information that could help a goldsmith translate the designs into fine metalwork? Can we see indications of metalsmiths' practices in the way that the ornament is represented in print? As a member of the Aggie Creative Collective, my research attempts to answer these questions through practice-based methodologies. I am producing a series of creative artifacts that explore ways a metalsmith might interpret an ornament print for translation into metal. I make two attempts to remediate a 2D leaf and tassel motif from a printed engraving into 3D artifacts using the very different metalworking techniques of repousse and chasing on the one hand and casting on the other. This requires reading the engraved lines as either invitations to create a relief object or one in the round. While my ethnographic research suggests that metalsmiths make this judgment immediately and automatically based on their professional habits and practices, my own naivety in this medium gives me greater distance to read these prints with deliberateness and attention. My work contributes to a new understanding of Renaissance conventions of representation and encourages further discussion and research on meaning behind the engraved marks in these prints, a subject of interest to both historians and practicing artists today.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #20: *Teresita A. Mecchi*

Major: Psychology

Faculty Advisor: Dr. Stephanie C. Payne

Lights, Camera, Anxiety: Understanding How Individual Differences Affect Reactions to Electronic Performance Monitoring

Electronic performance monitoring (EPM) is the use of technology to collect and analyze employee behavior in the workplace. In recent years, EPM has become common practice across a variety of industries for tracking and recording employee performance. While EPM can lead to increased productivity and more accurate employee evaluations, previous research has shown that it also raises significant concerns about invasions of privacy and increased stress in the workplace. Despite this growing body of research, few studies have explored how individual differences in employees might influence these outcomes. Trait anxiety is a critical individual difference that may be able to predict how psychological reactions to EPM differ from employee to employee. This experiment explored the relationship between trait anxiety and employee reactions to two distinct EPM conditions. Participants were randomly assigned to either an administrative EPM condition, emphasizing rule-following and strict feedback, or a developmental EPM condition, emphasizing support and growth-oriented feedback. They were then monitored in a simulated workplace and given performance feedback consistent with their assigned condition. Prior to the simulation, participants completed a survey to assess their trait anxiety. Immediately following the experience, participants reported their levels of stress, fairness, and the perceived purpose of the monitoring. Our findings indicated that participants in the administrative condition were more stressed than those in the developmental condition. We also found that trait anxiety was positively related to stress experienced during EPM, regardless of EPM condition. However, trait anxiety was not associated with the perceived purpose for EPM, nor did it moderate the relationship between EPM condition and stress or fairness, or predict changes in unsafe behavior over time. These results suggest that while highly anxious individuals experience greater stress under monitoring, trait anxiety does not alter the influence of EPM conditions on employee outcomes.

Poster Session 1: 9:30 AM-10:30 AM CT
Room C

Poster #21: *Riccardo Orlandi*

Major: Maritime Studies

Faculty Advisor: Dr. JoAnn DiGeorgio

Plastic Pollution and Arctic Communities

Plastic pollution is a rapidly globalized environmental issue, disproportionately affecting marine-dependent coastal Indigenous communities that rely on ocean food webs for cultural identity, well-being, and economic prosperity. This research examines the cultural impact of plastic pollution on the Arctic Inuit community whose traditional subsistence way of life is increasingly threatened by microplastic pollution and marine litter. Because ocean currents transport plastic trash from distant areas to Arctic coastlines, the Inuit suffer food security interruptions, loss of spiritual connections to the land, and detachment from traditional ecological knowledge. Inuit hunters and fishermen have also indicated higher plastic levels in sea mammals and fish, directly impacting their traditional food-sharing and challenging the Inuit world view, which is largely centered around respect for the land and the sustainable harvest of resources. Moreover, leached chemicals from plastics inflict severe health effects, adding to the marginalization of already vulnerable communities that are exposed to industrialization and climate change. The Inuit remain resilient by uniting for change, advocating for stricter environmental protection, and collaborating with scientists to record the magnitude of plastic pollution. Organizations such as the Inuit Circumpolar Council have also become policy leaders in creating solutions to plastic pollution at regional and global levels.

Poster Session 2
11:00 AM-12:00 PM CT
Room C

Poster Session 2: 11:00 AM-12:00 PM CT

Room: MSC 2300 C

Poster #1: *Emma Jedmears*

Majors: Forensic Investigative Science, Entomology

Faculty Advisor: Dr. Jeffery Tomberlin

Development Time and Validation of Phormia regina (Diptera: Calliphoridae) from Kansas City KS, USA

Forensic entomology is frequently used to estimate the time of colonization (TOC), when insects first arrived to a descendant, and deposited eggs or larvae. This can be accomplished through estimations of insect age based on the species development times and local weather data. The data for this calculation are obtained through development studies typically performed in laboratory environments. However, the accuracy and precision of such estimates are impacted by various factors, including the geographic location a species originated from, which presents potential issues if the development data utilized is for the same species in a different area. This study focused on Phormia regina, (Diptera: Calliphoridae), the black blow fly, which was collected as immatures from swine remains in Kansas, USA, and used to establish a colony at the Forensic Laboratory for Investigative Entomological Sciences (FLIES) at Texas A&M University. The purpose of this study was to determine the time for each development stage of these specimens. In addition, a validation study was conducted to determine the accuracy of this development set as compared to carcasses with a known time of placement. Specimens were reared at three separate temperatures, 25^{0}C, 20 ^{0}C, and 15 ^{0}C, on beef liver. The flies reared at 25 ^{0}C were shown to require 304 hours to complete development, with a survivorship average of 66.9% ± 0.1%. Development time, survivorship, and length for the remaining temperatures, 20 ^{0}C and 15 ^{0}C are still being evaluated as is length for 25 ^{0}C. The validation study assessing the accuracy of the development study is currently being analyzed. These data provide the first development study and validation work for Kansas.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #2: *Collin Bohannon*

Major: Biomedical Engineering

Faculty Advisor: Dr. Abhishek Jain

Engineering Living Vein-Chips with Complex Venous Waveforms

The veins of the lower extremities rely on muscle contraction to propel blood upward toward the heart. The hemodynamics generated by this are essential for vascular hemostasis. In-vitro models often rely on constant flow profiles that do not reflect the true complexity of human venous circulation. This project combined a living vein-chip system with clinically observed venous waveforms to observe endothelial function in a deeper capacity. This experiment hypothesizes that the waveform that imitates mobile muscle contraction will result in healthier endothelial cell function. The study has three parts: (1) Engineering complex venous waveforms from immobile and mobile states inside a vein-chip, (2) creating 2D simulations of the vein-chip to analyze the effect of different waveforms within the device, and (3) examining how these flow behaviors affect endothelial function. First, Doppler waveforms collected from bedridden patients were replicated using a patented, high-precision pump system called the HemaDyne. Then, simulations with these waveforms were created in ANSYS to analyze minor flow changes within the vein-chip. Finally, the devices were seeded with endothelial cells to observe endothelial function under immobile and mobile flow waveforms. The resulting simulations showed vorticity within the valve cusps expected within the literature, with physiologically similar flow behaviors being demonstrated within the vein-chip. Extreme drops in wall-shear stress in the venous cusps compared to the lumen channel were found, with higher drops being observed in the immobile waveform. With this data, endothelialized vein-chip devices pumped with the mobility waveform are expected to exhibit healthier functionality when compared to immobile treated devices.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #3: *Rohan M. Jain*

Major: Biomedical Engineering

Faculty Advisor: Dr. Gerard L. Coté

Novel Noninvasive Device for Continuous Blood Pressure Monitoring

Approximately 82.6 million people in the United States suffer from a cardiovascular disease. To prevent the development of many of these cardiovascular diseases, blood pressure must be monitored and controlled. Cuff based technologies for blood pressure measurements are cumbersome, and can be sensitive to motion. Further, these devices give only discrete measurements, offering no insight on blood pressure fluctuation due to activity, white coat syndrome, or masked hypertension. To address the limitations of these technologies, a pressure sensing ring device was designed for the purpose of continuous, noninvasive blood pressure measurement. The device was designed to be comfortable and convenient, and its wireless design will allow for freedom of motion during use. Further, the device's dual sensor design allows it to be robust against motion artifacts, by allowing for common mode rejection of noise. This novel ring utilizes strain gauge technology to measure surface level pressure changes due to arterial pulsation in the finger. Blood pressure can then be calculated by taking into account the extent of attenuation of the blood pressure signals by underlying tissue. The device was tested on human subjects, and the resulting data was compared to simultaneously collected measurements obtained from a gold standard reference device: the Finepres Nova. The subjects varied their blood pressure during these trials by using a leg press machine, allowing for a large range of blood pressure measurements to be taken.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #4: *Nanthanat Chumpirom*

Major: Forensic Investigative Science

Faculty Advisor: Dr. Victor Ugaz

Optimizing Amplification Reactions in a Convective Environment

Amplification reactions are commonly used and scientifically accepted methods of producing upwards of millions of copies of nucleic acid sequences for further analysis. Polymerase chain reaction (PCR), considered to be the most common of these techniques, is used to amplify selective sequences from a DNA sample through 3 different thermal stages to stimulate denaturation, annealing, and extension. This process is tedious, time-consuming, and greatly disadvantageous when performed on a larger scale; alternatives to current amplification methods, including small-scale thermocyclers and optimized techniques, can assuage this ongoing dilemma. This project has investigated the utility of dynamics observed by Rayleigh-Bénard convection, where a known vertical temperature gradient induces predictable convective flow to catalyze the process of moving reagents through the three stages of PCR. Additionally, this project investigates optimizing a similar type of process called exponential amplification reaction (EXPAR) to perform the same function. It is hypothesized that when employing both of these reactions under Rayleigh-Bénard conditions, the elimination of isothermality and predicted fluid motion is capable of catalyzing the amplificaition reaction, also inducing higher specificity and longer selective target lengths. Successful results, if achieved, suggest that cPCR and cEXPAR can be used in substitution of large-scale PCR for amplification purposes, and replace their functions in point-of-care diagnostics and forensic DNA analysis.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #5: *Alejandro Mejias*

Major: Chemistry

Faculty Advisor: Dr. Wenshe Liu

Synthesis and Biological Characterization of Novel BRD9 Inhibitors

Hematological malignancies remain a leading cancer diagnosis throughout the world. One avenue for more personalized cancer treatment involves the targeting of epigenetic regulators responsible for expression of cancerous oncogenes. One such regulator is the switch/sucrose nonfermentable chromatin remodeling complex (SWI/SNF), which contains the bromodomain BRD9. BRD9 is responsible for transcription of the MYC oncogene, and small molecule targeting has been shown to result in suppressed tumor proliferation in some types of hematological cancers. This project aims to develop novel small molecule inhibitors of BRD9 based on the previously unexplored benzimidazole moiety. Based on prior computer simulations performed in the lab, two compounds having favorable binding interactions with BRD9 were identified. A seven and six step synthetic route have been proposed for Compound 1 and Compound 2, respectively. Steps one through six have been performed for Compound 1 with high yields. Two attempts for the final coupling reaction, were performed with varied reaction conditions, however, they were ultimately unsuccessful. A second route involving aromatic substitution and a tosylated alcohol leaving group was developed and performed. This reaction conditions led to cleavage of the tosylated alcohol. The third route developed involves conversion of an earlier aryl alcohol intermediate to an aryl halide, sulfide formation, and oxidation to yield the final product. The third route is currently being executed. Since the sulfonyl needed in Compound 1 mirrors that in Compound 2, Compound 2's synthesis has been paused after the first two reactions so that the final step can be optimized. Once enough of Compounds 1 and 2 are developed, IC50 determination will be performed using the Alpha Screen assay. The final expectation of the project is to have an optimized synthetic scheme of two novel inhibitors with biological data determining if advanced in-vivo studies are warranted.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #6: *Dhruv Patel*

Major: Biology

Faculty Advisor: Dr. Michelle Hook

Delayed Intraosseous Phenylephrine Administration as a Therapeutic Strategy for Sci-Induced Bone Loss

Spinal cord injury (SCI) results in rapid bone loss below the level of injury, leading to severe osteoporosis and a dramatic increase in fracture risk. Unfortunately, despite its significant impact on quality of life, there is no effective treatment for SCI-induced osteoporosis. Current clinical interventions primarily target disuse and reduced mobility, but these approaches have shown limited success, suggesting additional mechanisms contribute to SCI-induced bone loss. Emerging evidence indicates that disruption of sympathetic nervous system signaling to bone may play a crucial role. Previous work from our laboratory demonstrated that acute intraosseous delivery of phenylephrine, an α1-adrenergic receptor agonist, preserves bone volume following SCI in a rat model. However, whether this strategy is effective after bone loss is already established, in the chronic phase of SCI, is unknown. This study investigates the therapeutic potential of delayed intraosseous phenylephrine administration in a chronic SCI rat model. Male rats received a moderate T11 spinal contusion injury or a sham injury followed by 28 days of recovery, over which SCI-induced bone loss developed. Phenylephrine or saline was then administered as a daily bolus directly to the bone marrow via an intraosseous catheter for an additional 28 days. Postmortem, bone structure was assessed using micro-computed tomography, immune cell populations were characterized by flow cytometry, and spinal cord lesion pathology was evaluated histologically to assess treatment safety. The study aims to determine whether restoring adrenergic signaling after chronic SCI can mitigate SCI-induced bone loss. Establishing the effectiveness of delayed phenylephrine treatment may provide a clinically relevant strategy to combat fracture risk while also improving outcomes for individuals living with chronic SCI.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #7: *Raj Nallanthighal*

Major: Computer Science

Faculty Advisors: Dr. Bobak J. Mortazavi, Dr. Gerard L. Coté

Machine Learning-Enhanced Control System for Physiological Phantom Pressure Simulations

The growing popularity and prevalence of wearable medical monitoring devices has created a strong need for efficient and reliable in-vitro testing platforms that accurately mimic human physiological function. Phantom systems and mock circulatory loops (MCLs) provide repeatable environments for this testing and validation. However, due to the complex relationship between mechanical input (pump voltage) and hemodynamic output (fluid pressure), they often require tedious processes of manual calibration. This difficulty is compounded by the nature of fluid dynamics and the problem of characterizing silicone phantoms. Not only are these manual calibration routines labor-intensive, but they can be time-consuming. This research proposes a two-stage method to automate and accelerate the calibration of phantom systems. The first stage uses a machine learning model to predict baseline input voltages to produce the desired output systolic (SBP) and diastolic (DBP) blood pressure based on user provided heart rate and phantom characteristics (e.g., physical dimensions, modulus). The second stage employs a control system to adjust the input pressure waveform dynamically to match the desired output waveform. This system ensures stability and convergence on a target hemodynamic state, such as 60 bpm at 120/80 mmHg. By automating manual tuning processes, this machine learning-enhanced control system supports a versatile and efficient testing platform for the future testing and development of medical wearable technology.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #8: *Risha Thimmancherla*

Major: Computer Science

Faculty Advisor: Dr. Shinjiro Sueda

Analytic Gradient Function Development from Signed-Distance Functions in Collision Detection

Signed distance functions (SDFs) are widely used in collision detection and physical simulation. SDFs function by returning a value for a given point that is indicative of a point's spatial relationship to a shape. Negative values indicate that the point is inside the shape (representing a collision). Positive values indicate that the point is outside the shape. In cases where the returned value is zero, the point is exactly on the surface of the shape. While SDFs for many shapes are well-established, their analytic gradient functions are often approximated numerically using finite differencing. This approach can be computationally expensive and sensitive to error, especially depending on step size. This project focuses on the derivation and validation of analytic gradient functions for common SDFs, in order to construct a reusable library for these shapes. In this project, analytic gradient functions are developed for four shapes of increasing complexity. Beginning with simpler shapes allows for validation steps to be identified early so they can be applied to more complex geometry. The underlying SDFs are adapted from an established SDF library and gradient functions are derived with assistance from AI. Each gradient function is validated using finite differencing comparison and gradient visualization before use in simulation. The SDFs are also used to generate implicit surface meshes for each shape for use in simulation and further verification of geometric accuracy. The reusable library of analytical gradients for primitive shapes enables further exploration for more complex geometry.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #9: *Morgan G. Peace*

Major: Neuroscience

Faculty Advisor: Dr. Annmarie MacNamara

Rolling the Dice or Earning Your Stripes: The RewP During Gambling vs. Skill-Based Reward Tasks

Humans maximize positive outcomes and minimize negative outcomes by learning which actions lead to reward versus punishment. This learning relies on the generation of prediction errors when feedback violates expectations; these modulate the midbrain dopamine circuit and cortical activity. Positive prediction errors are indexed by the reward positivity (RewP), an event-related potential (ERP) component that occurs in response to reward and is calculated as the difference in neural response to positive and negative feedback. The RewP is context-dependent, increasing when individuals perceive their choices impact outcomes. However, research has largely overlooked skill-based perceived control: a learnable form of perceived control in which improved performance yields better outcomes. Thus, this study compared the RewP in 67 undergraduates using two tasks, Doors (perceived control) and Time Estimation (TE; skill-based perceived control). Feedback responses were analyzed across mean area amplitude ERP, PCA ERP, source localization, and time frequency. This novel multimethod approach provides a more complete view of RewP modulation by perceived control. Analyses revealed the RewP was larger during Doors, implying stronger reward response during perceived control than skill-based perceived control. However, this effect was driven by increased responses to TE negative feedback, suggesting that the motivational salience of negative feedback is enhanced when improved performance can lead to better outcomes. Evidence across analyses was convergent. Source localization showed increased ACC and MFG activity to TE negative feedback, reflecting established roles in error monitoring to improve outcomes. Theta, a frequency that responds to negative feedback, mirrors these results. Conversely, the PCC was more active for positive feedback and TE, in line with its role in processing successful and self-relevant outcomes. Together, results suggest that the RewP may index feedback processing as a means of adjusting behavior to obtain rewards rather than just reward response.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #10: *Samyuktha Balaji*

Major: Psychology

Faculty Advisor: Dr. Rebecca Schlegel

The Tapestry of Religion: How Religious Engagement Intertwines with Identity and Meaning in Life

Meaning in life (MIL) is a crucial component of psychological well-being, encompassing the individual sense of coherence, purpose, existential significance, and existential appreciation. Religion, a central meaning-making system, is frequently treated as a monolithic construct by empirical studies. This blurs the distinctions between religious identity and religious engagement. This present study sought to disentangle these components through the examination of religious identity as a mediator of the relationship between religious engagement and MIL. Additionally, it investigated whether religious identity mediates the path between behavior and overall existential benefits. 320 participants were recruited from a public university in the United States to complete a self-report questionnaire. Correlational analyses showed moderate positive associations between religious identity and overall meaning in life, as well as the four facets. Multiple regression and mediation analyses suggested that identity is directly related to MIL, but this relationship is not mediated by religious engagement. Additionally, when considered together, only religious identity predicted meaning, suggesting that performing religious behaviors has a negligible impact on an individual's reported meaning once its shared variance with religious identity is accounted for. Conversely, moderation analyses indicated a significant interaction between religious engagement and religious identity in predicting general meaning in life and two facets (purpose and experiential appreciation). Simple slope analysis revealed that religious behavior positively predicts meaning at high levels of identity, but negatively predicts meaning at low levels of identity. This suggests that religious behavior is only an effective source of meaning for those at relatively higher levels of identity. These findings highlight the importance of identity for the self's meaning-making processes and underscores the importance of distinguishing the impact between religious identification and religious engagement when examining the consequences of religiosity. This, in turn, advances theoretical specificity and emphasizes pathways through which individuals may cultivate their sense of meaning in life.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #11: *Catie R. Samson*

Major: Psychology

Faculty Advisors: Dr. Robert Heffer, Dr. David Kahn, Dr. Eleanor Su-Keene

Pathways to Resilience: How Parenting Styles and Youth Emotional Regulation Shape Youth Resilience in the Face of Parental Internalizing Symptoms

Many parents find themselves ill-equipped to raise a child, and in a world of increasing information and varied opinions, it can be hard to determine what child-rearing practices are ideal. Caregivers shape much of children's crucial early development, and their behavior can dramatically change child outcomes. Notably, children in households with parental mental illnesses often develop attachment, coping, and behavioral issues. Despite their situations, some youth grow into well-adjusted adults due to their resilience. Given that emotional regulation significantly predicts resilience in adolescents, identifying factors that mediate its development is essential to understanding how some grow through adversity. Prior research has explored the role of parenting styles on emotional regulation and resilience. While there have been explorations of these themes in the context of groups such as Chinese-American and Hispanic populations, research has underexplored the impact of parents with internalizing disorders. We collected data through the Counseling & Assessment Clinic from parent-child dyads to explore connections between parents with internalizing disorders and parenting style on their children's emotional regulation and resilience. Expected results will depict a negative relationship between authoritarian parenting styles and youth resilience for parents with internalizing disorders, and youth with greater capacities for emotional regulation may have a greater likelihood of resilience.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #12: *Emma Tillery*

Major: Neuroscience

Faculty Advisors: Dr. Sherecce Fields, Dr. Zina Trost

Late-Diagnosed ADHD and Associated Risks in College Women: The Role of Diagnostic Timing

One-fourth of students seeking support through disability resources at Texas A&M are diagnosed with attention-deficit/hyperactivity disorder (ADHD), a neurodevelopmental disorder marked by impulsivity, inattention, and difficulties in executive function and self-regulation. Likewise, ADHD is estimated to be prevalent in two to eight percent of college students across the United States. Despite its growing prevalence, the depth of literature documenting gender differences in ADHD symptomatology is insufficient, with surfacing literature suggesting women face distinct challenges. Identified challenges include difficulties in interpersonal relationships and self-regulation, increased comorbidities, impairments in psychological and psychosocial functioning, and increased risk of sexual victimization. Still, the extent of these challenges remains unclear, despite university students' increased exposure to environments where substance use, sexual assault, and health risk are highly prevalent. In this mixed-methods study, we seek to further explore the impacts of these gender differences and the experiences of college women with ADHD. College women, recruited through the university's SONA system, will complete self-report measures assessing ADHD symptom severity, comorbidities, demographic characteristics, health risk behaviors, and other relevant psychological variables. Following survey completion, a subset of both late- and early- diagnosed women will participate in a semi-structured interview to further explore their experience. Outcomes will offer insights into the relationship between late-diagnosed ADHD and associated health risks among college women with the disorder. An increased understanding of these relationships may be essential for improving the treatment of this population and facilitating the adjustment of students after receiving a late diagnosis during their undergraduate studies.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #13: *Michaela Dunn*

Major: Agricultural Communications & Journalism

Faculty Advisor: Dr. Holli Leggette

From Classroom to Confidence: A Survey-Based Evaluation of Student Perceptions of Science Communication Training at Texas A&M University

Science communication is increasingly crucial today as public perceptions of scientific issues directly influence individual decisions and collective outcomes. While many universities, including Texas A&M University, offer science communication training, there are limited studies on how effective these are or how participants perceive their learning experience. My study evaluated the effectiveness of science communication training at Texas A&M and explored students' perceptions of their overall learning experience. Grounded in Bandura's (1977) social cognitive theory, which demonstrates that self-efficacy is a central component of behavioral change, data were collected from students who had completed at least one communication- or writing-intensive course at Texas A&M. Participants completed a survey based on Rodgers et al. (2020)'s Science Communication Training Effectiveness scale that measures self-efficacy, confidence, perceived knowledge, attitudes toward coursework and instruction, outcome expectations, training satisfaction, and behavioral intentions. Results showed participants reported moderate perceived knowledge but high self-efficacy, confidence, and positive expectations for applying communication skills. These findings suggest that science communication training may not be effective in enhancing perceived knowledge immediately, but such training is effective in enhancing students' self-efficacy in relation to learning and communicating scientific information effectively, which is critical in their overall continued application outside the classroom setting.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #14: *Isabel Renova*

Major: English

Faculty Advisor: Sarah LeMire, M.S., M.A.

Show, Don't Tell: An Examination of Twenty-First Century Jane Austen Adaptations

Jane Austen's novels have inspired a wide range of film and television adaptations, introducing her beloved characters to new generations of viewers. The twenty-first century has introduced a tonal shift in Austen's adaptations, depicting a vibrant, energetic, and comedic world that displays a markedly different story from its predecessors and, at times, Austen's original novel. Autumn de Wilde's EMMA. (2020) and Carrie Cracknell's Persuasion (2022) undergo this tonal transformation, simultaneously altering the themes of class and rank that define Emma and Persuasion. Through the lens of visual storytelling and "show, don't tell," this presentation analyzes De Wilde and Cracknell's depictions of class and rank, and whether these films preserve the societal structures of the Regency era. De Wilde's EMMA. reframes Emma's biased narration of class through its use of servants, cinematography, and color grading. By displaying a vivid version of Highbury society, the film inadvertently shifts the social position of the novel's primary hero, Mr. Knightley. In contrast, Cracknell's Persuasion presents a flattened version of Austen's class structure, using modern ideas of wealth that overlook the implications of rank and class for the novel's events. Consequently, Cracknell's Persuasion excludes the clear separations of social positions that define Austen's critique of class and mobility. By analyzing EMMA. and Persuasion, this research examines what makes an adaptation successful for modern audiences, arguing that the alteration of social critique reshapes the narrative framework of Austen's novels.

Poster Session 2 11:00 AM-12:00 PM CT
Room C

Poster #15: *Danny Nguyen*

Major: Computer Science

Faculty Advisor: Dr. Meng Xia

Mosaic: An Inspiration Assistant

Inspiration seeking is a critical yet under-supported phase of UI and web design, often requiring designers to leave their primary tools to browse external sources such as design galleries, blogs, or past projects. These workflows interrupt creative flow and make it difficult for designers to meaningfully connect references to their current design goals. While recent AI-assisted design systems emphasize automated generation of websites and interfaces, they provide limited support for early-stage ideation, exploration, and reflection which are key stages where designers are still forming and reframing ideas rather than producing final artifacts. In this paper, we present Mosaic: An Inspiration Assistant that supports designers before and between design sessions through retrieval-driven exploration rather than direct generation. The system allows designers to retrieve relevant visual and textual inspiration from a structured database of real-world websites and interface elements. Instead of producing complete designs, the assistant surfaces concrete precedents that designers can interpret, compare, and adapt to their own creative intent. The system is designed to preserve creative agency by enabling designers to explore alternative layouts, styles, and structural patterns without prescribing a single solution. We describe the system's architecture and interaction design, which link visual regions of interfaces to their semantic and structural representations and allows designers to engage with inspiration at varying levels. Through this work, we demonstrate how AI systems can function as creativity support tools that augment, rather than automate, design ideation. We conclude by discussing implications for future human–AI co-creative design workflows and for supporting early and interstitial phases of the design process that are poorly served by existing tools.

Poster Session 3
1:00 PM-2:00 PM CT
Room C

Poster Session 3: 1:00 PM-2:00 PM CT

Room: MSC 2300 C

Poster #1: *Atharva Shastri*

Major: Chemical Engineering

Faculty Advisor: Dr. Abdoulaye Djire

Niobium Carbide MXene Synthesis and Effects of Nitrogen Reduction Reaction

The importance of Ammonia (NH3) in agriculture and manufacturing is immense, particularly for its role in fertilizers that support global food security. Beyond this, NH3 is vital in wastewater treatment, pharmaceuticals, and energy production. However, its current production via the Haber–Bosch process is highly energy-intensive and a major contributor to global CO2 emissions, exacerbating climate change. Electrochemical nitrogen reduction reaction (NRR), powered by renewable energy, offers a sustainable alternative but is hindered by low Faradaic efficiency due to the competing hydrogen evolution reaction (HER). Enhancing FE requires catalysts with high selectivity towards NRR. Traditional NRR pathways, such as associative or dissociative mechanisms, involve energy- intensive N≡N bond cleavage. In contrast, the Mars–van Krevelen (MvK) mechanism bypasses this step, offering a lower-energy route by forming NH3 directly from lattice nitrogen. After NH3 desorption, vacancies are replenished by N2 gas, enabling continuous operation. Considering these attributes, nitride-based catalysts may provide the most favorable pathway for the realization of the NRR technology. Low-dimensional nitrides, such as MNenes (MXenes), are more favorable for the MvK mechanism due to their higher electrical conductivity, surface area-to-volume ratio, and facile access to N sites when compared to bulk nitrides. This project hypothesizes that the transition metal identity of a MNene will affect the MvK activity due to varying M-N bond strength. To test this, MNenes will be synthesized with different transition metals such as Ti, Nb, and V, and their NRR performance will be evaluated in neutral electrolytes.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #2: *Jorden Quast*

Major: Electrical Engineering

Faculty Advisor: Dr. Christi K. Madsen

OTDR Spatial Resolution Improvement Through Blind Deconvolution

Deconvolution is a signal-processing approach for improving the spatial resolution of Optical Time Domain Reflectometers (OTDRs) without adding hardware complexity. Deconvolution relaxes some of the resolution constraints due to bandwidth, allowing for the construction of systems with the same performance at a lower cost. Previous work in the field has achieved success by employing a variety of deblurring methods developed for image processing, with neural networks and iterative optimization being the most popular options. However, all methods currently applied to OTDRs are limited by their requirement to accurately measure the injected pulse profile. This limits applicability for in-field systems, since the pulse profile is not often collected or stored, and methods to measure it prove impractical. We are attempting to offer a more broadly applicable solution by studying the feasibility of blind deconvolution in OTDRs using numerical optimization. The algorithm is adapted from image processing and operates by starting with the nominal pulse width and making alternating estimations between cable data and pulse profile in order to iteratively refine both. To validate results and test a wider variety of configurations, a simulation engine was built to allow for modular system construction. Upon the completion of planned experiments, the results will demonstrate whether spatial resolution can be improved through blind deconvolution in an OTDR, enabling pre-existing systems to receive a spatial resolution increase at minimal additional complexity.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #3: *Annalaine Whitson*

Major: Electrical Engineering

Faculty Advisor: Dr. Matthew Johnson

Thermal and Electrical BLDC Motor Co-Design and Experimental Characterization

Selection of electric motor type and size is important in applications including transportation, manufacturing, and HVAC. Depending on the motor application the power, torque, speed, and precision requirements will vary. Motor sizing is an important design decision that depends on the use case requirements. The performance and efficiency of a DC electric motor depend on principles of electricity and magnetism that describe the production of magnetic flux in the machine and the resulting forces. This process depends on the electrical and thermal properties of the machine which are co-dependent. Therefore, this project will address the problem of creating an accurate model of an electric motor by co-simulating the electrical and thermal behavior of the motor. The co-simulation will be performed using Ansys Electronic Desktop, a finite element analysis software for electric machines. The model will be based on a real off the shelf brushless DC motor. The simulation will be performed with a focus on the relationship between the motor temperature and efficiency. This simulation will be experimentally validated to accurately predict the efficiency, temperature, and overall performance of the motor under various operating conditions.This modeling and experimentation will provide insight into the interdependency of motor efficiency, performance, and cooling and assist in determining if the motor is suitable for a use case.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #4: *Mohammed Al-Jaber, Abdulla Al-Shahwani, Ahmad Al-Emadi, Abdallah Abualam*

Major: Chemical Engineering, **Major:** Chemical Engineering, **Major:** Chemical Engineering, **Major:** Chemical Engineering

Faculty Advisor: Dr. Patrick Linke

Methane to Hydrogen Pathways in Qatar: A Comparative Techno-Economic Assessment

As Qatar considers how to limit carbon emissions and continue its status as a global energy leader, hydrogen is now more likely to be seen as a promising avenue to a lower-carbon future. The environmental advantages of hydrogen are, however, highly dependent on its production. In the present day, natural gas-based processes produce most of the hydrogen, and they nevertheless emit a significant amount of carbon. The paper compares the four hydrogen production technologies that are of specific interest to the energy environment of Qatar: Steam Methane Reforming (SMR), Partial Oxidation (POX), Autothermal Reforming (ATR), and Methane Pyrolysis. The most commonly used form is SMR, which is used currently in industry, but it emits a lot of carbon dioxide. POX and ATR provide alternative pathways to reforming that are more thermally efficient and that are better fit to carbon capture and storage (CCS). Specifically, ATR can deliver a concentrated stream of CO2, and it is therefore ideal to make large-scale blue hydrogen in the already existing natural gas and LNG infrastructure of Qatar. Methane pyrolysis is a relatively newer technology that does not directly generate CO2, but rather generates solid carbon in its place. Although this route has great potential for lowering emissions, it encounters technical issues regarding the functioning of the reactor, heat supply, and carbon management. This study follows a comparative research design and uses life-cycle emissions and techno-economic factors to assess the carbon intensity, efficiency, and practicality of each technology. Emphasizing the unique industrial situation in Qatar, the paper indicates the trade-offs between existing, short-term solutions and new low-carbon technologies. The findings will be used to promote informed decisions regarding the development of hydrogen in Qatar, as well as to comment on how gas countries may shift to more sustainable hydrogen production.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #5: *Matthew Caldarola*

Major: Electrical Engineering

Faculty Advisor: Dr. Philip Hemmer

Nitrogen Vacancy (NV) Center Growth and Entanglement for Neuron Mapping

Nitrogen Vacancy (NV) centers are special crystal lattice defects that can be used to detect very minute changes in magnetic field. By possessing a quantum property known as spin, a NV center emits an intensity of light dependent on its spin when irradiated by a laser beam, and thus by observing the effect that a magnetic field has on properties of a NV center spin, emitted light from the NV center can then be utilized to detect the magnetic field present. If two NV centers are placed near each other, then the magnetic field detected by one NV center can be compared to the magnetic field detected by the other NV center, thus creating a device able to detect the change in magnetic field over space, with very high precision. Additionally, NV centers have the ability to be entangled with one another, a quantum mechanical phenomenon that causes the quantum state of one NV center to be dependent on the quantum state of another NV center, in essence that the spins of entangled NV centers are dependently linked to each other. By working towards the fabrication of nearby NV centers in nanodiamond by means of a custom ion implantation technique and then entangling the NV centers by means of microwave pulses, a very high precision gradiometer will be developed and characterized, further explained by means of developing a framework to describe the fabrication of NV centers in nanodiamond (given the custom ion-implantation setup) and model the entangled gradiometer. If time permits, additional applications of entangled nearby NV centers will be explored for means of implementing quantum logic for quantum computing by treating each NV center as a qubit ("quantum bit") upon which quantum operations could be performed to yield a desired quantum computational result.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #6: *Caleb Brown*

Majors: Mathematics, Physics

Faculty Advisor: Dr. Saskia Mioduszewski

Recalibration of the STAR Experiment's Run 15 at Brookhaven National Laboratory

The Solenoid Detector at the RHIC (Relativistic Heavy Ion Collider) experiment at the United States Department of Energy's Brookhaven National Laboratory, or simply the STAR experiment, has been a quintessential component to understanding and uncovering the physics of quark-gluon plasma (QGP) and continues to do so today, 25 years after its first run. The creation of QGP, a state of matter that has only existed naturally in the first few microseconds of the universe, is done through colliding gold nuclei at velocities close to the speed of light, with the actual collision taking place inside the detectors of the RHIC, such as STAR. From the creation of the QGP, a high-energy photon and a jet of particles are produced, back-to-back with each other. The detector then records a large swath of information (number of events, energy deposited, particle type, jet track information, time of flight, etc.) through the many subsystems that make up the detector, such as the Time Projection Chamber (TPC), Hadron Flavor Tracker, and Barrel Electromagnetic Calorimeter (BEMC), with the BEMC being the primary point of focus for this paper. The BEMC is intricate, being a cylindrically shaped calorimeter that surrounds the inner time projection chamber, with positions along it being measured in an azimuthal angle and pseudo-rapidity (the angle measured from the collision beam), and possesses two subsystems of its own. These subsystems include an arrangement of 4800 scintillator towers, and within these towers, the Shower Maximum Detector (SMD), which is composed of 36000 multi-wire strips. These systems work to resolve the energy and positions of incoming particles and rely on calibration constants of their own in order to accurately measure the physics of the collision. In Run 15, such an error arose when the Time Calibration Constant was incorrectly chosen part of the way through the data collection of Run 15, which has seemingly shifted the higher ends of the energy spectrum to lower values. This paper discusses the various techniques used to attempt to recalibrate Run 15 data and the results that have followed from the implementation of said techniques.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #7: *Alisa Lu, Neeraj Gogate*

Major: Computer Science, **Majors:** Mathematics, Computer Science

Faculty Advisor: Dr. Samson Zhou

Online Low-Rank Approximation Via Adaptive Spherical Partitioning

We study the problem of online low-rank approximation, where at each time step an algorithm receives a new vector and must maintain a rank-k subspace that serves as a compressed representation of the data. The specific formulation we use is the weighted low-rank approximation (WLRA) objective: at each step, the algorithm incurs loss equal to the weighted squared reconstruction error of the incoming point with respect to its current subspace. The goal is to minimize regret against the best rank-k subspace in hindsight, whose reconstruction cost we denote by C. We first establish an online-to-offline reduction: the existence of an efficient no-regret online algorithm for WLRA would imply an efficient approximation scheme for the offline problem, which is unlikely under standard complexity assumptions. Although WLRA is APX-hard in the offline setting, we show that the standard Multiplicative Weights Update Algorithm (MWUA) can achieve sublinear regret in expectation with respect to a (1 + ε)-multiplicative approximation of C. Specifically, we use an adaptive spherical hierarchical region decomposition that iteratively refines the d-dimensional unit sphere S^d based on the density of the data. At each split, a region is partitioned into 2^(d-1) sub-regions, producing a hierarchal tree decomposition, while our algorithm maintains centroids of the points in each region as the set of experts. Finally, we complement our theoretical results with empirical evaluations that demonstrate the efficiency of our algorithm compared to previous baselines.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #8: *Gentry Rogers*

Major: Biology

Faculty Advisor: Dr. Chieh Chen

Female Gonadal Hormones During Trauma May Account for Their Higher Risk of Developing PTSD

Post-traumatic stress disorder (PTSD) is a chronic, deleterious mental disorder that can develop following a traumatic event. PTSD affects 8-26% of women, and women are 2-3 times more likely than men to develop PTSD, even after accounting for the type of trauma. This suggests that an inherently female trait may modulate the risk of PTSD after trauma in women. Since gonadal hormones play a crucial role in many sex differences, we investigated whether the estrous cycle of female rats affects the development of PTSD-like symptomatology after trauma. For this study, we utilized the well-published and validated rat model of PTSD, Single Prolonged Stress (SPS), to expose adult female rats to trauma during different stages of their estrous cycle. Rats then underwent fear conditioning, fear extinction, and extinction recall to determine the severity of extinction recall deficits, a cardinal deficit in patients with PTSD. Findings indicate that despite similar behavior to control animals during fear conditioning and fear extinction, female rats exposed to SPS exhibit extinction recall deficits. Further analysis revealed that female rats that underwent SPS during the proestrus stage of their cycle exhibited more significant deficits in extinction recall compared to those that underwent SPS during other cycle stages. It was also determined that the estrous stage on the day of fear conditioning or fear extinction did not affect extinction recall behavior. To eliminate the possibility that a group difference was falsely identified, a separate cohort of animals was tested in the same paradigm, and the same findings were replicated. Collectively, our data indicates that undergoing SPS during proestrus, the cycle stage in which estrogen and progesterone are at their peak, increased the risk of developing PTSD-like symptoms. This suggests that female gonadal hormones on the day of trauma may account for the higher prevalence of PTSD in women. Furthermore, this indicates that treatment approaches may need to be sex dependent and that current practices should be reconsidered.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #9: *Bryson Gottschall*

Major: Neuroscience

Faculty Advisor: Dr. Jennifer Dulin

Roles of Excitatory DREADD Receptors on Motor Recovery Utilizing Spinal Cord Neural Progenitor Cell Grafts After Spinal Cord Injury

Spinal Cord Injury (SCI) reduces the quality of life for millions worldwide. Neural progenitor cell (NPC) transplantation into lesioned spinal cord tissue is a promising approach for restoring neurological function after SCI by grafting new neurons and supporting cells for incorporation into host circuitry. Despite these beneficial findings, the functional motor recovery recorded after NPC transplantation remains modest. In the developing nervous system, the activity of immature NPCs plays a crucial role in the formation and maintenance of new synapses. Thus, we sought to determine whether continuous, early graft excitation enhances the synaptic integration of transplanted NPCs to host circuitry. Chemogenetic activation of NPCs using designer receptors exclusively activated by designer drugs (DREADDs) offers a repeatable and non-invasive method of excitation. The route of activation involves comparing the first-generation activator Clozapine N-oxide intraperitoneal injections and the third-generation activator Deschloroclozapine (DCZ), utilizing a novel voluntary jelly administration. We found that early activation of grafted NPCs after SCI significantly impacts graft survival compared to delayed graft activation. The voluntary oral administration of DCZ is comparable to CNO injections, and repeated activation of NPCs does not significantly affect grafted composition or size. Collectively, these findings highlight the importance of activation time periods of transplanted NPCs post-SCI and provide a less stressful chronic DREADD activator administration route via voluntary oral administration.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #10: *Alyssa Sutton*

Major: Marine Biology

Faculty Advisor: Dr. Jessica Labonté

Seasonal Variability and Microdiversity of Cyanophages in South Central U.S. Freshwater Lakes

Viruses play a crucial role in the microbial community by regulating host populations and ecosystem function in aquatic environments. Cyanobacteria viruses, or cyanophages, are known to impact biological processes, such as the release of toxins that cause harmful algal blooms (HABs). The direct impacts cyanophages have on HABs through their interactions with their hosts are complex and poorly studied, especially in freshwater environments. The objective of this study is to characterize freshwater cyanophages ecology, specifically seasonal dynamics and virus-host relationships. The dataset used for this study contained 1763 cyanophage genomes from twenty reservoirs in Texas distributed across an East-West precipitation gradient, all prone to HABs. The lakes were sampled twice per year (in April and in August) over three years (2021-2023). To address how cyanophages' hosts taxonomy is connected to their seasonal dynamics, a cluster analysis of the relative abundance of the cyanophages was performed. This revealed 25 clusters with distinct seasonal variations. Some clusters showed peaks in certain lakes that could indicate how cyanophages may be implicated in the dissipation of blooms. Taxonomic profiles for some clusters showed phages that infect the same genus of cyanobacteria clustered together. Such was the case of Cluster #2, dominated by phages infecting Planktothrix, which was determined to be the main HAB species in the sampled lakes. To evaluate the microevolutionary trends in Planktotrix phages, the microdiversity of the cyanophages in Cluster #2 was assessed. Three lakes, Buffalo Springs (BF), Waco (WC), and Ray Hubbard (RH), had significantly higher microdiversities across multiple seasons, suggesting that high host densities, as is the case during a bloom, may increase viral evolutionary rates. These trends can be used to understand cyanophages' effect on HABs and thus aid in developing mitigation strategies for HABs to reduce the impacts on ecosystem and human health.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #11: *Hope Matteson*

Major: Marine Biology

Faculty Advisor: Dr. Lene Petersen

Effects of Human Pharmaceuticals on Daphnia magna Physiology and Behavior

Presence of pharmaceuticals in aquatic environments has become an increasing concern since they were first documented in 1977. The continuous increasing use of human and animal pharmaceuticals requires the constant evaluation of their impacts on such organisms. While multiple studies have examined effects of pharmaceuticals on aquatic non-target organisms, there is a need to conduct high-throughput assessment of several pharmaceuticals at the same time and to examine several biological end-points (e.g., behavior and physiology) to provide a comprehensive understanding of the effects of pharmaceuticals on aquatic wildlife. The goal of this study was to examine the physiological (oxygen consumption rate) and behavioral (changes in movement patterns) effects in the freshwater aquatic invertebrate species, Daphnia magna. Adult Daphnia were exposed for 24h to either nicotine, carbamazepine or prednisone at 10ug/L and 100ug/L. These pharmaceuticals were selected due to their ubiquitous presence in the aquatic environment and high usage and prescription rate. Metabolic rate and movement ability (distance moved, velocity of movement) were determined using a microrespirometer and a Daniovision tracking system. Results show that each pharmaceutical had different effects on oxygen consumption rate but there did not appear to be a concentration related effect (10 ug/L vs 100 ug/L). In contrast, dose-dependent effects were seen in the behavioral data (distance moved and velocity of movement). Results will be discussed in the context of their medical application in target users to enhance understanding of how human pharmaceuticals affect non-target freshwater aquatic organisms.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #12: *Colin Luu*

Major: Biology

Faculty Advisor: Dr. Kristine Korzow

Meta-analysis of Dental Calculus Data

Humans are unique in that they are the only animals that regularly consume the milk of other animals and possess multiple genetic mutations that help us continue to digest milk into adulthood. One method in studying dairy consumption in the past is palaeoproteomics–the study of ancient proteins–extracted from dental calculus. With this method already having ten years of produced data from multiple labs that use different extraction methods, instrumentation, and analysis, paleoproteomics can now be better assessed for robustness. This is especially notable now with palaeoproteomics expanding rapidly each year beyond the small group of researchers with established knowledge of the methods. I am looking specifically at the impact of the choice of analysis pipelines (program, database, parameters, and filters), potentially on the identification of dairy peptides in dental calculus samples analyzed by tandem mass spectrometry. I am identifying existing data and analyzing it using several different pipelines, comparing them to each other as well as the original source. I will then formulate a standardized method that can be used to best identify the presence of dairy in dental calculus. This research will help display how analysis choices bias the results that lead to false positives or inconsistent identification. By reanalyzing published datasets, this project highlights which factors play a stronger role in influencing results and contribute to establishing better practices in the field of paleoproteomics.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #13: *Tristan Brown*

Major: Biomedical Sciences

Faculty Advisors: Dr. Staci Horn, Dr. Fred Clubb

Use of Radiographic Imagery in the Optimization of Bone Decalcification

Decalcification plays a crucial role in preparing tissues containing high concentrations of calcium, such as bone or calcific plaques, for paraffin histology. Paraffin histology techniques require that the tissues have a consistency comparable to wax. Inconsistencies of tissue and the embedding medium densities will increase the chances that the tissue is damaged during the process and preclude an accurate histology analysis. Bone samples are harder to cut through than adjacent soft tissues (e.g., muscle, tendons, etc.). Removing the calcium from bone will make the bone tissues softer and easier to cut through without any leftover cutting artifacts. This is why decalcifying bone samples is important – decalcifying helps remove calcium from the sample, which in turn balances out the densities between the bone and soft tissue, making the sample easier to assess in histology. A consistent challenge with decalcification is not knowing when to remove the sample from the decalcification solution. When removed too early, the problem of too much calcium persists, making histology more difficult, or in some cases, entirely impossible. Although if removed too late, we can experience a decline in tissue structure and an excess in the destruction of nucleic acids. Most tissues in the decalcification solution are removed periodically, and the hardness is tested by puncturing the tissue with a needle or cutting through the tissue with a blade. These methods may cause unnecessary damage to the tissue and potentially hinder histological analysis in any areas of interest. This research aims to use a set of variously sized chicken bones tested in Formical-4, a decalcification agent, over an array of times to assess the progress of decalcification. Periodically x-rays will be used to measure the densities of the tissue throughout the decalcification process and provide a more precise, non5 invasive approach to tissue assessment. With my project, I hope to come up with a surer way of concluding when a sample is finished within the decalcification solution

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #14: *Sarah I. Kakwan*

Major: Biomedical Sciences

Faculty Advisor: Dr. Stephen Safe

Evaluating the Anti-carcinogenic Effects of Coffee-Derived Compounds on Colorectal Cancer

Colorectal cancer (CRC) is the third leading cause of cancer-related mortality worldwide, and its rising incidence among young adults highlights the urgent need for novel therapeutic approaches. Coffee-derived bioactive compounds, including caffeic acid (CA), chlorogenic acid (CGA), and kahweol, have emerged as promising interventions capable of reducing CRC cell survival through anti-cancer properties; however, their molecular mechanisms remain unclear. NR4A1 (nuclear receptor subfamily 4 group A member 1) is an oncogenic transcription factor from the nuclear receptor family that is overexpressed in CRC and is known to regulate genes involved in tumor survival and proliferation, including survivin and β-integrin. This study aims to investigate whether coffee-derived compounds reduce CRC cell viability through modulation of the NR4A1 signaling pathway and its downstream targets. Human (HCT116 and SW480) and murine (CT26) CRC cell lines were grown to 70-80% confluency and treated with increasing concentrations of CA, CGA, or kahweol, producing nine treatment groups. Cell viability was analyzed using a resazurin assay and a multi-mode microplate reader. Based on dose-response results, one low and one high concentration per compound were selected for protein analysis using Western blotting and fluorescence imaging. Data significance was evaluated using statistical analysis. Preliminary results revealed that CGA, CA, and kahweol significantly reduced viability in HCT116 cells at all concentrations, while CGA and CA significantly reduced viability at higher concentrations in SW480 and CT26 cells compared to background controls. Further analysis using optimized concentrations may enhance survivability reduction in CT26 and SW480 cells. Ongoing protein analysis will focus on NR4A1 and its downstream targets, survivin and β-integrin, which contribute to apoptosis regulation, cell cycle progression, and proliferation signaling, to determine whether coffee-derived compounds reduce CRC viability through suppression of NR4A1-mediated oncogenic pathways.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #15: *Kevin Liu*

Major: Electrical Engineering

Faculty Advisor: Dr. Jian Tao

Generating Synthetic Longitudinal EHRs

Electronic health records (EHRs) are a key resource for clinical research and decision support, but their reuse is constrained by strict privacy regulations and limited data access. This study introduces a TimeGAN-based pipeline for generating synthetic EHR data that preserves patient-level temporal structure while mitigating privacy risks associated with the dataset. From the raw EHR dataset, it split and cleaned orders events into per patient visit sequences, encodes features, pads and normalizes sequences, trains a GRU-based TimeGAN, and decodes samples back into synthetic temporal dataset. The generated data is evaluated by comparing real versus synthetic cohorts using structural and diversity summaries, including patient and visit counts, unique medication and diagnosis counts, top-k code coverage, date diversity, and patient-level medication sequence patterns. Additionally, distributional comparisons and temporal analyses (such as visit-gap statistics) are used to assess how closely the synthetic data matches real-world patterns beyond simple cohort-level counts. To approximate downstream utility, I include a simple Markov next-medication baseline. Sequence matches and nearest-neighbor Jaccard similarity between synthetic and real patient medication profiles were used as privacy indicators, measuring whether synthetic trajectories are exact copies of real ones or unusually similar to specific real patients. The synthetic data matches the overall structure of the processed EHR and is diverse across medications, diagnoses, and dates, with no evidence of collapse or widespread duplication. However, the synthetic data still differs from the real data in key ways with the main focus on medication frequencies, visit-gap patterns, and next-medication transitions.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #16: *Rahul Rajendran*

Major: Computer Science

Faculty Advisor: Dr. Ruihong Huang

Understanding Morality-Related Biases in LLMs: A Cross-Demographic Fine-Grained Analysis

The prevalence of large language models (LLMs) in high-impact domains raises important concerns regarding moral reasoning and value alignment. As LLMs are trained on large-scale corpora, human beliefs, societal norms, and prejudices inherently get captured in model representations. In this paper, a fine-grained analysis of morality-related biases in LLMs is explored across multiple demographic characteristics (e.g., age, race, ability). Existing work on social and moral bias in LLMs emphasizes gender bias, highlighting systematic differences in moral judgments when presented with male versus female subjects. While these findings highlight the importance of evaluating moral bias, moral reasoning is shaped by a variety of social attributes. Therefore, it is important to understand broader and more nuanced patterns of social bias. To investigate this issue, we construct parallel moral scenarios, such that demographic characteristics are systematically perturbed without altering context and narrative structure. This allows for controlled comparisons of model-generated moral judgments and accompanying rationales across demographic conditions. We then examine how distributions of moral opinions shift across population groups. This work aims to provide a more comprehensive understanding of how morality-related biases are present in LLMs across diverse demographic contexts. By broadening the scope of moral bias evaluation beyond gender, this study contributes to ongoing efforts to assess and improve the fairness, robustness, and ethical alignment of LLMs deployed in morally sensitive applications.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #17: *Roman Parker*

Major: Computer Science

Faculty Advisors: Dr. Tracy Hammond, Dr. Adam Kolasinski

Adaptive Factor Allocation for Macroeconomic State-Aware Factor Investing

This project develops a Dynamic Factor Allocation Model that combines machine learning factor discovery with macroeconomic regime detection to improve equity portfolio performance. Traditional factor models assume that style factors like value, momentum, and quality have consistent behavior over large time scales, but research shows their performance often varies with changing economic conditions. Using publicly accessible equity data, we apply Instrumented PCA (IPCA) and similar techniques to locate latent & interpretable factors to capture time-varying loadings. At the same time, we use Bayesian changepoint detection and hidden Markov models to spot larger shifts in macroeconomic regimes in near real time. These regime factor premia are applied via a Black-Litterman allocation framework, adjusting factor exposures as regime shifts occur. This provides an algorithm for factor investing capable of reacting to macroeconomic regimes without sacrificing the interpretability and stability that makes traditional style factors effective.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #18: *Audrey Hillam*

Majors: International Affairs, Modern Languages

Faculty Advisor: Dr. Andrew Natsios

USAID and African Development: An Analysis of Competing Interpretations

This paper examines how the United States Agency for International Development (USAID) and its critics frame the agency's influence on African development. Rather than assessing USAID's effectiveness in absolute terms, the analysis focuses on the construction of competing narratives, the assumptions underlying them, and the types of evidence each side prioritizes. Drawing on institutional documents, scholarly critiques, and historical context, the paper shows that USAID presents itself as a constrained but collaborative partner engaged in long-term capacity building, while critics portray the agency as part of a broader system of dependency and neo-colonial influence. These narratives diverge not simply because of disagreement over outcomes, but because they operate within fundamentally different frameworks, employing distinct definitions of development, standards of evidence, and interpretations of history. Whereas USAID relies primarily on technocratic evaluation and program-level indicators to demonstrate progress, critics emphasize structural power relations, historical experience, and questions of sovereignty that are less easily captured by institutional metrics. The paper further traces the origins of anti-USAID arguments to colonial legacies, Cold War-era distrust, influential intellectual traditions in development critique, and contemporary political and media discourse that amplifies skepticism toward foreign aid institutions. By clarifying why these competing frames persist and frequently talk past one another, the paper contributes to broader debates about aid, sovereignty, and institutional legitimacy in African development. In doing so, it highlights the importance of understanding not only how development agencies operate, but also how their actions are interpreted within historically and politically charged contexts.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #19: *Gabriella M. Olivo*

Major: Philosophy

Faculty Advisor: Dr. David Koepsell

Rendered Stateless: Deontological Ethics and Labor Exploitations in the Dominican Republic

This paper argues that the treatment of stateless individuals of Haitian descent in the Dominican Republic's sugarcane industry violates the moral duty owed to stateless individuals under deontological ethics. The analysis combines empirical analysis with philosophical reasoning, drawing on legal documents, court rulings, and existing empirical studies to evaluate the ethical responsibilities of state and corporate actors. The Dominican Republic has faced international criticism for their 2013 court ruling that revoked birthright citizenship from thousands of Dominicans with Haitian descent whose parents were deemed in transit at the time of their birth, effectively rendering them stateless. Haitian citizenship laws require at least one parent to be a native-born Haitian citizen. This is a significant concern, as many generations have permanently settled within the sugarcane communities. As a result, many affected do not qualify for either Dominican or Haitian nationality. This legal exclusion confines individuals with Haitian descent to exploitative labor conditions resembling indentured servitude. Companies have both moral and legal obligations to ensure their commercial partners are abiding by safe working conditions and ethical labor practices. Continued economic support of Dominican sugarcane producers perpetuates cycles of generational instability and undermines the protection of human rights. This paper argues that the Dominican state, sugar producers, and the U.S. companies purchasing Dominican sugar, neglect their moral duty to respect human dignity and protect basic human rights under deontological ethical obligations.

Poster Session 3 1:00 PM-2:00 PM CT
Room C

Poster #20: *Skylar Minnitte*

Major: Psychology

Faculty Advisor: Dr. Kristine Korzow

The Human Redefinition of the North American White-Tailed Deer Population

In the early 20th century, overhunting and improper land management led to a steep decline in the North American white-tailed deer population, nearly driving them to extinction. To combat this reduction, multiple states participated in a restocking attempt, distributing deer across the continental United States. This effort helped grow the population to an estimated 30 million or more, but the lack of proper documentation for this movement has likely altered the natural population. For instance, black-tailed deer are native to the Pacific Coast, whereas white-tailed deer are historically native to the central and East Coast regions of the United States. Even with this geographical distinction, there is substantial evidence that these subspecies were displaced, creating an opportunity for interbreeding between black-tailed deer and white-tailed deer. The offspring of this condition would result in a hybrid mule deer, potentially altering the genetic makeup of the ensuing generations. My research utilizes archival data and literature alongside current and previous laws to construct a better understanding of how the deer population has shifted over time as a result of human interaction and policy. I have worked with historical and modern samples of deer to gather DNA and collagen for insight into genetic variation and evolutionary shifts in the Odocoileus virginianus species. This data is being collected through Polymerase Chain Reaction (PCR) and Zooarchaeology by Mass Spectrometry (ZooMS) and will likely be available later in the spring of 2026.

Poster Session 4
2:15 PM-3:15 PM CT
Room C

Poster Session 4: 2:15 PM-3:15 PM CT

Room: MSC 2300 C

Poster #1: *Eduardo Silva, James Lee, Kayson Hergert, Ben O'Neal, Yousuf Shafiu*

Major: Mechanical Engineering, **Major:** Mechanical Engineering,
Major: Mechanical Engineering, **Major:** Mechanical Engineering

Faculty Advisor: Dr. Gray Thomas

The Role of User Preference in the Direct or Autonomous Control of Knee Exoskeletons

Many of the contemporary issues plaguing assistive exoskeletons stem from user interactions. These problems are often attributed to inefficiencies in the methods used to exert control over the system, which largely rely on autonomous control algorithms that mimic the user's biological walking patterns. However, the user's biomimetic walking patterns may not accurately reflect their true preferences. Previous work has shown that giving the user direct control over the exoskeleton's behavior results in control schemes that differ significantly from the typical biomimetic walking profile (Z. Bucknor-Smartt et al., "Direct User Control of Knee Exoskeleton," 2025). As a result, the ultimate goal of this study is twofold: to understand the preference between personalized user-generated torque profiles and the more generic biomimetic torque profile scaled by weight, and whether the cognitive load of direct user control of an exoskeleton influences the preferred control scheme. The primary methodology for gait-phase estimation will be an Extended Kalman Filter. Output torque will be delivered to the user's knee via a lookup table of either the biomimetic profile scaled by weight or the user-generated torque profile. Finally, the user will compare the given choices and select their preferred method. This will be accomplished by sampling twenty participants performing various tasks whilst controlling an exoskeleton both autonomously and directly. With this preference in mind, a user survey will be conducted to more closely determine their preferred profile and how closely it aligns with the typical biological response. These survey results can then be used to provide insight into the ideal method of exoskeleton control.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #2: *Matthew Fisher*

Majors: Applied Mathematics, Computer Science

Faculty Advisor: Dr. Tim Davis

Graph Generators in the Language of Linear Algebra with GraphBLAS

This paper discusses the implementation of a small group of graph-generation algorithms written with the SuiteSparse: GraphBLAS C api. GraphBLAS is a framework based on linear algebra which optimizes operations on sparse graphs: graphs with a significantly low number of edges relative to the size of the graph. LAGraph is a collection of useful graph algorithms whose fundamental operations have been dissected and implemented in a manner that leverages GraphBLAS for linear-algebra based computation that is inherently parallel. These algorithms are often faster than their single-threaded counterparts in other graph and network libraries, but their true power lies in their simplicity. Due to their nature, LAGraph algorithms are efficient, easy to write, easy to use and modify, and easy to chain together for more complex network analysis. When writing these algorithms, however, developers require test data to verify correctness and ensure reliability. While many datasets are publicly available already, it is convenient to be able to create these datasets from scratch. However, not just any random assortment of edges will provide a meaningful graph to run these algorithms on. For example when modeling a social network, it would be odd if each person randomly connected with a handful of random others. It would instead make more sense for some of a person's connections to connect with each other as well. Therefore we must use specific algorithms for graph generation which ensure these graphs maintain patterns that are similar to real datasets. The first algorithm designed and discussed in this paper is a simple wrapper for the existing random matrix algorithm. Next is the RMAT (Recursive Matrix) algorithm, the first to employ a formula that allows for more interesting generation. RMAT uses weights for each quadrant and recursively selects a quadrant until a specific edge is created. Lastly is the Preferential Attachment algorithm which ties the likelihood of a node gaining a new edge to the number of edges it already has. This collection will provide future developers more ways to test their LAGraph algorithms.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #3: *Rhys Vennema*

Major: Computer Engineering

Faculty Advisor: Dr. Suin Yi

Wafer-Scale Fabrication of Self-Rectifying Memristors for In-Memory Computing

In-Memory-Computing (IMC) has emerged as a promising solution to the limitations of traditional computer architectures, which are inefficient in high-memory low-computation workloads such as vector matrix multiplication (VMM). VMM is a major operation in artificial intelligence and machine learning workloads, making efficient hardware implementations increasingly important as the demand for computing power continues to grow. Among the candidates for IMC hardware, self-rectifying memristor crossbars (SRMCs) are attractive due to their high integration density, low power consumption, intrinsic sneak path suppression, and CMOS compatible fabrication. Despite these advantages, challenges related to fabrication process compatibility, device yield and device-to-device (D2D) variability remain significant barriers to wide scale adoption of SRMC based systems. In this work, a well performing SRMC reported in Self-Rectifying Memristors with High Rectification Ratio for Attack-Resilient Autonomous Driving Systems is reproduced at wafer scale in a research fabrication environment to evaluate device yield and variability. A TiN/HfOx/Pt device structure is fabricated, reproducing a SRMC that is highly compatible with existing CMOS technologies. Fabrication details identified as critical to successful device yield are discussed in detail to aid in reproducibility of SRMCs. Electrical characterization is performed to assess self-rectifying behavior, switching characteristics and uniformity across devices. Additionally, atomic force microscopy (AFM) and X-ray photoelectron spectroscopy (XPS) are employed to confirm physical device structure and to investigate the material and interface mechanisms enabling self-rectification. These results provide insight into the manufacturability, scalability, and process sensitivities of the TiN/HfOx/Pt SRMC device, as well as common challenges associated with SRMC fabrication in general. This work highlights both the feasibility and remaining obstacles of deploying SRMCs for practical IMC applications.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #4: *Santiago A. Gonzalez, Jonas Pearson, Aaron Edwards, Carson Murdock*

Major: Mechanical Engineering, **Major:** Mechanical Engineering,
Major: Mechanical Engineering, **Major:** Mechanical Engineering

Faculty Advisor: Dr. Gray Thomas

H.A.N.D

This study investigates the design and performance of a tendon-driven, strength-augmenting robotic hand. The project aim was to develop a strength-amplifying hand system that takes user input and provides an enhanced output. The robotic hand consists of three, two degree-of-freedom fingers and a compliant palm, which is controlled by the user through a "voodoo" hand. The "voodoo" hand and actuated system take user input and transmit the actuated output to a separate robotic output hand. Novel mechanisms include a fully mechanical actuation system through the use of bowden cables, rolling contact joints, fingernails, and soft finger pads for compliant grasping. To achieve high-fidelity motion reproduction, while keeping the input fully mechanical, the robotic hand utilizes rolling contact joints to connect the finger phalanges, facilitating a parallel routing between the controller and output hand. This system is integrated via Bowden cables, which minimize mechanical slack and regulate the tension throughout the system's range of motion. To optimize terminal interaction, rigid finger nails were integrated at the end-effector of the finger. This addition facilitates grasping thin-profile objects, such as coins or paper, and is complemented by soft finger pads that improve grasp efficiency. Early findings revealed the system could operate with a minimum strength amplification factor of 180%. Limitations included a $5000 budget and the sponsor requirement of no teleoperation.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #5: *Alfred Hale*

Major: Electrical Engineering

Faculty Advisor: Dr. Pao-Tai Lin

Comparing Evaluation Methods for Memristors and Miniature Biosensors

Memristors are special, unutilized components that could revolutionize memory storage systems and computing. Paired with miniature biosensors, systems could be created that understand, interact with, and impact natural elements. While their theoretical applications are vast and highly useful, the first critical step is to create them as functional and reliably manufacturable as possible. To do so, an evaluation framework must be developed that can identify the physical and electrical characteristics of the memristors and miniature biosensors. With this information, they can be properly characterized, separated into different categories based on their performance and use-cases. However, since they are not well-defined, this research identifies and compares different evaluation systems, highlighting differences and anticipated results. There are two types of evaluation systems observed in this project: a custom-built system reliant on a Field Programmable Gate Array (FPGA), and a pre-built system using National Instruments' CompactRIO (NI cRIO) processing kit. For the FPGA system, a PCB was designed and manufactured to bridge the memristors and biosensors (or "Devices Under Test" [DUT]). The NI cRIO system had a simpler set-up, that takes the external pads found on the DUT and connects them to modules on the NI cRIO with wires. Once attached, impedance measurements and current and voltage analysis were performed on each DUT and the results would be compared. Unfortunately, due to complications with the memristors and biosensors, as well as the evaluation systems themselves, results were not attained. While this study has not produced the results intended, it provides valuable insight into designing custom evaluation systems and common issues that can occur, providing tested knowledge that others can learn from when attempting a similar project.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #6: *Shreyaa Sathya Balaji*

Major: Biology

Faculty Advisor: Dr. Hongmin Qin

Will Cariporide Alter Cell Migration Under Acidic pH?

Cell migration is essential for airway epithelial repair following injury, yet acidic extracellular pH markedly impairs migration in normal bronchial epithelial cells while promoting invasive behavior in cancer cells. The sodium proton exchanger NHE1 is activated under acidic extracellular conditions and is known to regulate intracellular pH, cytoskeletal anchoring, and actin turnover. While NHE1 has been extensively studied in ischemic injury and cancer metastasis, its role in non-cancerous airway epithelial migration under acidic stress remains poorly defined. This project investigates whether NHE1 supports migration of 16HBE14o- human bronchial epithelial cells exposed to acidic extracellular pH. Cell migration will be assessed using scratch assays under control and acidic conditions, ranging from physiological pH to severe acidic stress near the viability limit. To evaluate NHE1 function, cells will be treated with Cariporide, a potent and reversible NHE1 inhibitor, and compared with untreated and vehicle control conditions. Time-lapse phase-contrast microscopy will be used to quantify migration rate and wound closure over time. We hypothesize that NHE1 activity facilitates epithelial migration under acidic stress and that inhibition of NHE1 will further impair migration in acidic environments. By directly testing this hypothesis, this study aims to clarify whether NHE1 serves a protective role in epithelial repair or whether alternative pathways dominate epithelial adaptation to acidic stress. These findings will advance understanding of how ion transporters regulate epithelial migration and will help distinguish mechanisms of cell motility in normal tissue repair from those exploited by cancer cells in acidic microenvironments.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #7: *Earlene Sun*

Major: Psychology

Faculty Advisor: Dr. Matthew Vess

How Beliefs about the True Self Color Judgments of Moral Value Conversions

Research indicates that people are biased to perceive others' true selves as morally good. (Newman et al., 2014). However, it is unclear if this bias emerges when the actor's change coincides with a compulsory intervention.? It is also unclear if this bias relates to people's views about the justness of "interventions" that violate people's individual rights (e.g., the right to free expression). The present research addresses these gaps. We hypothesized that, even in the presence of a compulsory intervention, people would see actors' changes as due to their true selves if the change aligned with their ideology. In Study 1, participants (N=601) accessed the survey online. They were asked to evaluate three criteria when given an actor who shifts in beliefs as a result of an intervention: authenticity, morality, and justness of intervention. To assure that the results were not due to the nature of the specific scenarios that the actor was described to be in, Study 2 (N=401) completed the same analysis as Study 1 with the use of different vignettes. Both studies returned results consistent with our hypotheses. Political conservatism was positively (negatively) associated with seeing actors' changes as an emergence of their true self when the change was in a conservative (liberal) direction. These results indicate that there is a robust tendency to see actors' changes to reveal their true selves if the changes are perceived to be moral. It emerges even in the context of a strong reason to doubt a fully self-determined change (i.e., in the presence of a compulsory intervention).

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #8: *Christopher Lo*

Major: Biology

Faculty Advisor: Dr. Jorge Cruz-Reyes

Characterization of Kinetoplastid Helicase 2 Associated Factor 4 Subunit within the RNA Editing Helicase 2 Complex of Trypanosoma brucei

Within Trypanosoma brucei, mitochondrial U-insertion/deletion (U-indel) RNA editing is thought to developmentally regulate respiration in response to the availability of sugars within its hosts. Specifically, with RNA editing, KREH2 (Kinetoplastid RNA Editing Helicase 2) has been observed to regulate canonical and noncanonical edits to the 3' end of pre-mRNAs in order to create repressive structures that prevent maturation of proteins that make up the complexes of the electron transport chain. This was contrasted with a relatively low level of noncanonical editing in procyclic form (PCF) in insects. The noncanonical editing serves to repress RNA relating to oxidative phosphorylation since bloodstream form has a relative abundance of sugar, so efficient metabolism is not required. The KH2F4 (Kinetoplastid RNA Editing Helicase 2 Associated Factor 4) subunit contains intrinsically disordered regions that may affect the specificity of RNA editing to the BSF electron transport chain pre-mRNAs. Through conditional floxing, mutants are being generated for the study of growth and editing phenotypes within the bloodstream and procyclic forms of T. brucei. The phenotypes will be observed through growth curves and RT-qPCR. By understanding the phenotypes, the significance of each of the four intrinsically disordered regions on the T. brucei's vitality may be elucidated.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #9: *Anastasia Pauken*

Major: Neuroscience

Faculty Advisor: Dr. Rahul Srinivasan

Identifying Mechanisms Driving Estrogen-Mediated Increases in Endoplasmic Reticulum Exit Site Formation and Autophagy

Parkinson's disease (PD) is the second most common neurodegenerative disorder and fastest growing neurological disorder globally. PD results from dopaminergic (DA) neurodegeneration in the substantia nigra pars compacta brain region. This neurodegeneration is caused by a wide array of factors, including oxidative stress and protein overload, which can increase endoplasmic reticulum (ER) stress within DA neurons. Over time, chronic ER stress can induce apoptosis and loss of DA neurons. Nicotine and the smoking cessation drug cytisine have been previously shown to reduce ER stress by acting as pharmacological chaperones of neuronal nicotinic acetylcholine receptors (nAChRs) and promoting the increased formation of endoplasmic reticulum exit-sites (ERES). Interestingly, data from our lab show a consistent correlation between ERES upregulation and neuroprotection. This observation leads to the hypothesis that ERES upregulation is potentially linked to increased autophagy, which can be neuroprotective. This study aims to characterize downstream cellular mechanisms that facilitate neuroprotection in the context of ERES upregulation. Given prior research suggesting that ERES formation is an important contributor to autophagy, this study will measure DA neuron ERES formation, changes in autophagic flux, and the activity of associated regulatory enzymes such as Casein Kinase 1 ε (CK1ε) in a mouse model of PD. Using the 6-hydroxydopamine (6-OHDA) mouse model, this project will measure these proteins in DHED-treated and control mice. Immunohistochemistry and confocal microscopy will be utilized to quantify these changes. Overall, this project will aim to uncover cellular pathways of estrogen-mediated neuroprotection in PD, and will seek to highlight novel strategies for halting neurodegenerative disease progression in both sexes.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #10: *Avery Balderas*

Major: Philosophy

Faculty Advisor: Dr. Roger Sansom

Evaluating Constructive Empiricism Using Biological Theories

Van Fraassen's theory of constructive empiricism asserts that the goal of science is to offer us empirically adequate theories, or theories that can accurately account for the phenomena we observe. Given that many different theories can fit this criteria, constructive empiricism argues that we base what theories we accept on pragmatic values. The framework of this theory has mainly been applied by its proponents to theories in physics. Yet, there is a near-absence of examples in any other scientific field. My aim is to remedy this deficiency by extending van Fraassen's examination to theories in biology. My objective is to first establish a philosophical framework for constructive empiricism's application by analyzing its foundation and criticisms against it. I will discuss the history of each biological theory, describe the theory as it now stands, and then describe a theory that has the most equivalent potential to result in the phenomena both theories intend to explain. I will use not only the historical presentations of these theories, but also present-day re-evaluations in order to have a comprehensive description for each. I will assess both theories and determine their strengths, weaknesses, similarities, and dissimilarities. Then, I will apply constructive empiricism to these theories and analyze how this viewpoint would interpret each theory I present. My expected outcome is a conclusive determination of each theory's scientific status through applications of van Fraassen's system.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #11: *Aidan Lee*

Major: Microbiology

Faculty Advisor: Dr. Courtney Fitzpatrick

Testing the Interobserver Reliability of Using 2D Photogrammetry to Measure Estrous Swellings

2D photogrammetry is a widely used method in studies to non-invasively obtain morphometric data of traits of interest. One such use is to study the functions of female sexual ornamental traits and their evolution. These traits are becoming more important to evolutionary biologists. A classical example of this is the swellings of the ano-genital tissue of Cercopithecine primates that correspond with the female's ovarian cycle. In a previous study done by Fitzpatrick et al., they used 2D photogrammetry to obtain images of the Amboseli baboon swellings over a period and provided the first study to model how environmental and social behavior factors affected swelling sizes. Because this was the first study done on the Amboseli baboon population, it is important to confirm that the methodology used is reliable. As such, we have replicated the method used by Fitzpatrick et al. and performed statistical analysis to measure its reliability and the agreement between their analysis and our new analysis using 2D photogrammetry. We found that using 2D photogrammetry had excellent reliability in measuring the width of estrous swellings with an ICC value of 0.988 and moderate reliability in measuring the length with an ICC value of 0.683. We found there was also little to no correlation between the lens extension used for obtaining the original images or human error and inconsistency with error rates.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #12: *Victoria Henson*

Majors: Marine Biology, Marine Fisheries

Faculty Advisor: Dr. Lene H. Petersen

Social Dynamic Between Cotton Top Tamarin (*Saguinus oedipus*) and Callimico (*Callimico goeldii*) Monkeys

The Cotton Top tamarin (*Saguinus oedipus*) has been a long term resident at the Moody Gardens Rainforest Zoo (Galveston, TX) and their captive behaviors are therefore well known amongst the staff. The Cotton Top tamarin is listed as critically endangered in the wild due to declining populations. In the spring of 2025, the zoo added another species to the enclosure, the Goeldi's marmoset (*Callimico goeldii*) [hereon referred to as "Callimicos"]. The Callimicos inhabit areas in the wild that do not overlap with the Cotton Top tamarins so they will never encounter each other in nature. The introduction of the Callimicos to Moody Gardens Rainforest thus opened new challenges to the staff. Extensive literature search revealed very little knowledge about the two species interactions and this research was therefore conducted to understand how the two species would interact in captivity, to investigate what the captive behaviors of the Callimicos would be if they were housed near the Cotton Top Tamarins and if the Cotton Top Tamarin behaviors changed in presence of Callimicos. The objectives of the study were: 1) Will the Cotton Top Tamarin and Callimicos interact with each other? 2) Which behaviors will be displayed by each species when they share the habitat? and 3) Which new behaviors are displayed by the Cotton Top tamarins in presence of the Callimicos? Given that the two species' habitat range does not overlap in the wild, it is important to understand if they are able to share an artificial habitat in captivity. This research addresses an important knowledge gap in its aim to provide insight to the captive behavior dynamics of the two primate species in a simulated rainforest setting. This research project further provides new knowledge of the behavioral interactions between these two species that can assist conservation efforts in the wild if species habitat ranges may overlap due to habitat destruction or climate change. The proposed research will further provide information to other zoos about the interaction between the two species which will help other facilities introduce the two species in the same habitat.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #13: *Kayley Vu, Lynn Kim*

Major: Visualization, **Major:** Visualization

Faculty Advisors: Dr. Bryan Kim, Dr. Jinsil Hwaryoung Seo

Creative Care: Enhancing Elderly Mental Health Through Immersive Memory Environments

Older adults benefit from structured reminiscence and family dialogue, yet many existing tools require clinical facilitation or isolate users during engagement. We hypothesize that an AI-assisted, photo-anchored interactive experience, delivered on virtual reality (VR), will increase user engagement, social connectedness, and positive affect when compared to conventional photo browsing experiences. This project will develop an IRB-approved immersive reminiscence experience for adults aged 65 and older, using participants' personal past photographs to construct immersive memory environments. The experience is designed to prioritize well-being, support reflective dialogue, and document emotional and cognitive responses during interaction. Additionally, the project examines how VR and personalized memory environments can enhance mental health outcomes while generating transferable design principles across human–computer interaction (HCI), game design, and gerontology. Participants in this study will be adults aged 65 and older who are not recruited from, affiliated with, or sourced through any residential care facility or clinical setting. Participation in the study is independent of any healthcare services, social programming, or support they may receive elsewhere. The study is exploratory and pilot in nature, with a primary focus on evaluating the participant experience within an AI-assisted, photo-anchored immersive environment delivered via a VR headset. Outcomes of interest include participant engagement, emotional response, and subjective experience during interaction with the immersive reminiscence system. This research is not intended to evaluate a clinical intervention, diagnose medical or psychological conditions, or deliver therapeutic treatment. Rather, it seeks to understand how emerging immersive technologies, when combined with personal photographic memories and AI-assisted interaction, can support meaningful reminiscence and social connection among older adults. Findings from this study will inform future research and design efforts aimed at developing accessible, non-clinical tools that leverage immersive environments to promote emotional well-being and positive affect in aging populations.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #14: *Gabriana Garrido*

Major: Biomedical Engineering

Faculty Advisor: Dr. Zachary Steelman

Evaluating Thermal Burns using Spectroscopic Optical Coherence Tomography

For burn injuries, slight variations in burn depth can drastically alter prognosis and optimal treatment, with superficial partial thickness burns healing naturally with conservative treatment, while deep partial thickness burns require surgical intervention. The current method for diagnosing burn depth is visual inspection, which has led to incorrect treatments. The motivation behind this project is to find a more precise method for evaluating burn severity to ensure proper treatment is completed for all burn patients. Burn injuries are classified based on depth and surface area; however, distinguishing the slight difference in depth between superficial and deep partial-thickness burns is difficult to assess visually, but necessary for proper medical intervention. An accurate, high-resolution imaging modality is needed to accurately diagnose the depth of burn injury. SOCT is a possible solution, but its depth limitations (typically 1-1.5 mm) restricts its use for deeper burns. To combat this, this project will investigate whether textural and optical properties of superficial injured tissue can indicate the depth of burn at deeper levels. Thermal burns were applied via direct contact with a heated copper square for durations ranging from 5 to 25 seconds. Burn sites were debrided and maintained under sterile conditions to minimize infection. Over a 30-day period, sites were imaged using a SOCT system to acquire B-scans. Biopsies were obtained to determine burn depth through histological analysis. Images were analyzed to assess changes in attenuation coefficients before and after burn induction and were correlated with burn depth. Attenuation coefficients increased with burn duration, indicating that the OCT-derived attenuation coefficient may be a useful diagnostic metric. Additional analysis is needed to evaluate whether SOCT-derived burn depth aligns with the histological findings.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #15: *Eilyn Caceres*

Major: Animal Science

Faculty Advisors: Dr. Iyabo Oluseyifunmi, Dr. Samson Oladokun

Dietary Bio-clay Product Modulates Organ Weights and Serum Biochemical Responses in Broiler Chickens Challenged with Aflatoxin

A total of 192 day-old off-sex Cobb-500 broiler chickens were used to evaluate the potential ameliorative effects of dietary Bio-clay product, a sodium-rich montmorillonite conjugated with ZnO, on aflatoxin (AF) toxicity in a 21-day study. Birds were randomly assigned to four treatments with eight replicates per treatment in a completely randomized design: (1) corn–soybean meal–based control diet, (2) control + clay minerals (8 g/kg), (3) aflatoxin challenge (2 mg/kg AF), and (4) aflatoxin challenge + clay minerals (2 mg/kg AF + 8 g/kg clay). Birds and feed were weighed on days 0, 7, 14, and 21 to calculate feed intake (FI), weight gain (WG), and feed efficiency. Blood samples and relative organ weights were collected on day 21. Relative bursa ($P = 0.014$) and spleen ($P < 0.001$) weights were higher in AF-challenged birds than control but comparable among other treatments. Liver weight was markedly lower ($P < 0.001$) in AF + clay birds compared to AFB_1 alone, indicating reduced hepatic stress. Serum glucose and cholesterol were lower ($P < 0.05$) in AF-challenged birds with or without clay, while alkaline phosphatase (ALKP) was higher ($P = 0.002$) in clay-only birds but comparable to control. Aspartate aminotransferase (AST) was lower ($P = 0.028$) in AF-challenged birds relative to control. Uric acid was higher in clay-only birds than aflatoxin-challenged group. Serum Na^+ and Na^+: K^+ ratio was higher ($P < 0.05$) in AF + clay birds than clay-only but comparable to other groups, while Cl^- increased ($P < 0.05$) with AF (with or without clay). Total antioxidant capacity (TAC), superoxide dismutase (SOD), and immunoglobulin Y (IgY) were not significantly affected ($P < 0.05$) by treatments. Bio-clay product recorded hepatoprotective effect and alleviated the adverse effects of aflatoxin exposure on serum biochemical parameters, whereas its effect on antioxidant and immunological markers was limited under these conditions.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #16: *Haley Blades*

Major: Animal Science

Faculty Advisor: Dr. Samson Oladokun

Effects of Dietary Bio-clay on Organ Weight, Serum Biochemistry, and Immune Response in Aflatoxin-challenged Broiler Chickens

This study investigated the efficacy of dietary Bio-clay product, a sodium-rich montmorillonite conjugated with ZnO in mitigating the toxic effects of aflatoxin (AF) in broiler chickens. A total of 192 day-old off-sex Cobb-500 broilers were allocated to 8 replicate cages of 6 chicks each and assigned to 4 treatments from hatch to day 28 : (1) control (corn–soy diet), (2) control + clay (8 g/kg), (3) AF challenge (2 mg/kg), and (4) AF challenge + clay (2 mg/kg AF + 8 g/kg clay). Growth performance was monitored and recorded on a weekly basis. On day 28, blood samples were collected for serum biochemical analysis, and relative organ weights were measured. The results showed that relative bursa weight was greater (P = 0.052) in the aflatoxin challenge + clay group compared to other groups, except for aflatoxin-only group. The relative spleen and liver weights were greater in the challenged group with or without clay. Nonetheless, a 5.77% reduction (P > 0.05) in liver weight was found in aflatoxin challenge + clay group relative to aflatoxin-challenge group, suggestive of reduced inflammation. Serum biochemistry revealed that the glucose and cholesterol were lower (P < 0.05) in aflatoxin-exposed groups (with or without clay) than in the control and clay-only groups and reverse is the case for chloride, an indication of alteration in lipid and glucose metabolism. Alkaline phosphatase (ALKP) was lower (P = 0.002) in aflatoxin-exposed groups (with or without clay) relative to control except clay-only group. Aspartate aminotransferase (AST was lower (P = 0.049) in AFB_1 + clay group relative to control but comparable to others. Glutamate dehydrogenase (GLDH) a marker of liver damage was reduced (P = 0.012) in aflatoxin challenge + clay group relative to aflatoxin challenge group by 23%. The serum immunoglobulin G level was unaffected (P = 0.477). Dietary Bio-clay partially mitigates aflatoxin-induced liver damage and inflammation in broilers but does not fully prevent metabolic disturbances or affect humoral immunity. Key words: Aflatoxin, Organ weight, Bio-clay, Serum biochemistry, Broiler chickens.

Poster Session 4 2:15 PM-3:15 PM CT
Room C

Poster #17: *Divya Phalak*

Major: Psychology

Faculty Advisors: Dr. Takashi Yamauchi, Dr. David Rompilla

Exploring the Overlap Between Emotional Acceptance and Cognitive Reappraisal: A Blind Categorization Study

Emotional acceptance and cognitive reappraisal are widely studied emotion regulation strategies that are traditionally conceptualized as distinct processes. Acceptance involves experiencing emotions without resistance, whereas reappraisal entails reinterpreting a situation to alter its emotional impact. However, emerging research suggests that acceptance may facilitate reappraisal, raising questions about a potential overlap in practice. The present studies investigated whether emotional acceptance naturally promotes reappraisal as part of its regulatory process. Two within-subjects studies were conducted with participants recruited from a research pool at a large Southern university. In both studies, participants viewed sad film clips and were assigned either an acceptance or reappraisal instruction, after which they typed what they thought about while regulating their emotional response. Study 1 examined strategy use in a non-cognitive control context, while Study 2 embedded the same prompts within a Stroop task to examine regulation under increased cognitive demands. Written responses were evaluated by independent raters blind to participant condition and categorized into three strategy types: positive reappraisal (actively reinterpreting the situation in a more positive or less negative light), detachment (psychological disengagement from emotional content), and emotional acceptance (experiencing emotions without attempting to change them). Interrater reliability was high across studies and conditions (Fleiss' κ range = .89–.97). Chi-squared goodness-of-fit tests revealed that strategy use differed significantly from an equal distribution across both studies. In Study 1, participants predominantly engaged in positive reappraisal regardless of whether they were assigned acceptance ($\chi^2(2) = 23.73$, $p < .001$; detachment N = 19, emotional acceptance N = 14, positive reappraisal N = 47) or reappraisal ($\chi^2(2) = 65.64$, $p < .001$; detachment N = 11, emotional acceptance N = 10, positive reappraisal N = 63). A similar pattern emerged in Study 2 under Stroop tasks, where participants predominantly engaged in positive reappraisal regardless of acceptance ($\chi^2(2) = 19.18$, $p < .001$; detachment N = 11, emotional acceptance N = 21, positive reappraisal N = 41) or reappraisal ($\chi^2(2) = 58.12$, $p < .001$; detachment N = 10, emotional acceptance N = 16, positive reappraisal N = 53) assignment. Together, these findings suggest that positive reappraisal is consistently favored, even when acceptance is instructed and when cognitive demands are high. This pattern supports the hypothesis that acceptance may facilitate reappraisal, and has implications for emotion regulation theory and intervention design.

Poster Session 5
3:30 PM-4:30 PM CT
Room C

Poster Session 5: 3:30 PM-4:30 PM CT

Room: MSC 2300 C

Poster #1: *Jesse Xiao, T. Chase Thompson, Collin Dawson, Braxton Wade*

Major: Electrical Engineering, **Major:** Electrical Engineering, **Major:** Electrical Engineering, **Major:** Electrical Engineering

Faculty Advisor: Dr. Aydin Karsilayan

Design of a Wireless Charging System for Medical Implants

Implantable cardiac pacemakers depend on internal batteries that require surgical replacement every 7 to 12 years, exposing patients to repeated medical risk, discomfort, and financial burden. This thesis is part of a larger team effort to develop a safe, and non-invasive wireless charging system capable of continuously recharging implanted medical devices without surgical intervention. The proposed solution employs a hybrid wireless-power-transfer architecture that combines far-field radio-frequency (RF) transmission through air, and then switches to ultrasonic power delivery through biological tissue, leveraging the strengths of each modality to overcome their individual limitations. At the system level, energy is transmitted from a wall or ceiling mounted phased array operating at a 5.8 GHz RF frequency, with the beam continuously calibrated to a patch worn by the patient. The received RF power is harvested, rectified, and used to charge a small intermediate battery. This stored energy is then converted into a 1 MHz ultrasonic beam, which is calibrated to focus directly on the implanted device using another phased array. A fourth on-chip receiver harvests the ultrasonic energy and uses it to charge an auxiliary battery that supplies power to the implant. Together, these four sub-systems are capable of potentially indefinitely expanding the lifecycle of low-power implanted medical devices.

Poster Session 5 3:30 PM-4:30 PM CT
Room C

Poster #2: *Gideon E. Wheatley*

Major: Biomedical Engineering

Faculty Advisor: Dr. Anne-Marie Ginn-Hedman

Effects of Student-Faculty Co-Design in a Biomedical Engineering Course on Student Outcomes

As technology becomes increasingly interwoven into our society, new teaching methodologies have emerged to both ease the burden on educators and increase engagement by students. The pandemic saw the emergence of asynchronous and remote education, and now with the emergence of generative machine learning models (or "AI"), educators of the past 5 or so years have faced shifts that have not been seen in decades. Additionally, the constant advancement of technology means that engineering curriculums must be ever adapting to shifting standards and expectations in industry. To match these ever shifting demands, many educators have started to experiment with the concept of "Co-Design," where the course curriculum is shaped by formal feedback and input from students on areas they wish they had been instructed more or less heavily in. This project is an extension of a broader initiative at Texas A&M University to implement course co-design and evaluate its efficacy in a variety of disciplines and fields. Biomedical engineering is a broad field ranging from bone fracture recognition software using AI to medical scissors. As such the curriculum encompasses a broad range of topics, but certain constants are necessary to ensure students who may have no interest in one class are still benefiting from it. To this end, this project examines a Biomechanics course (essentially classic mechanics/physics applied to human physiology) to determine the effect of student-faculty co-design on student preparedness for future coursework and confidence in personal ability across several "transferable skills" outlined as: teamwork/interpersonal skills (ability to settle group conflict, divide tasks among group members, overall confidence in others to contribute equally, etc.); ability to critically analyze and apply standards/documents in order to justify project decisions; and confidence in technical tools (SolidWorks or other computer aided design tools, common laboratory equipment used in mechanical testing).

Poster Session 5 3:30 PM-4:30 PM CT
Room C

Poster #3: *Zhenhao Li*

Major: Electrical Engineering

Faculty Advisor: Dr. Jose Silva Martinez

Design of High-Speed, High-Resolution SAR ADC

The exponential growth in global data traffic, driven by 6G wireless communication and high-speed wireline links in hyperscale data centers, necessitates analog-to-digital converters (ADCs) that simultaneously achieve multi-gigahertz bandwidth and high dynamic range. This paper presents a [Sampling Rate] GS/s, [Resolution]-bit Time-Interleaved (TI) Successive Approximation Register (SAR) ADC implemented in 40nm CMOS technology. To overcome the speed-limitations of single-channel architectures while maintaining superior power efficiency compared to flash alternatives, the design utilizes an 4-way interleaving factor with a 500MS/s, 12 bit single channel asynchronous SAR ADC core.

Poster Session 5 3:30 PM-4:30 PM CT
Room C

Poster #4: *Osama Hasoneh, Aiman Mohammad Ali*

Major: Electrical Engineering, **Major:** Electrical Engineering

Faculty Advisor: Dr. Jim Ji

HearMe: Digital Stetho Badge

HearMe is a wearable continuous lung sound monitor that combines chest-mounted MEMS microphones with edge-AI to enable long-term, privacy-preserving respiratory assessment outside clinical settings. The system acquires lung sounds via a dual-microphone acoustic front end, performs bandpass filtering and noise reduction on an ESP32-S3-based central node, and streams buffered audio segments to a smartphone for local preprocessing and deep learning inference using OPERA foundation models. Extracted log-mel spectrograms and MFCC features feed two models: an Adventitious Sound Detection module that labels coughs, crackles, and wheezes, and a Respiratory Disease Recognition module that estimates the likelihood of asthma or COPD from temporal patterns in detected events. A graphical interface supports trend visualization, quality indicators, and event-level feedback to patients and caregivers, facilitating early detection of deterioration and data-driven care decisions. Compared with existing cloud-dependent wearable stethoscopes, the proposed system emphasizes edge-first processing, reduced transmission of raw audio, and an 18–24 hour operating time on a single charge, aiming to deliver continuous, user-friendly monitoring suitable for everyday use in home environments.

Poster Session 5 3:30 PM-4:30 PM CT
Room C

Poster #5: *Evan Konieczny*

Major: Electrical Engineering

Faculty Advisor: Dr. Oscar Moreira

ASIC for DVD Drive Based Laser Scanning Microscopy

Laser scanning microscopy (LSM) is a process that moves a laser over a target, gathering data from the reflected beam and compositing an image. LSM has applications in medical testing where it is used to generate sub-cellular images, and extracts depth information in addition to the 2D picture. However, the cost barrier for LSM is high, and reducing system cost could increase equipment availability for underfunded laboratories thereby expanding access to both academic research and clinical imaging capabilities. A solution is the use of inexpensive DVD drive hardware that can already provide sub-micron laser positioning. This research presents a novel Integrated Circuit (IC) similar to a DVD driver chip for controlling a DVD-drive-based Laser Scanning Microscope. The integrated circuit is comprised of several functional blocks: The bandgap voltage reference, the voltage regulator, the current reference, the charge pump, the H-bridge stepper motor driver, the linear voice coil driver, and the analog-to-digital converter. Existing DVD drive ICs provide good functionality for the DVD hardware, but are highly optimized for DVD scanning and lack features such as dual stepper motor control. Our design aims to provided similar functionality but is optimized for laser scanning microscopy. Optimization goals include more accurate stepper motor and voice coil control drivers to improve speed and quality of image capture, as well as an integrated digital core to close control loops on-chip. If produced at scale, integration of these systems into a single chip will reduce cost and complexity of the system.

Poster Session 5 3:30 PM-4:30 PM CT
Room C

Poster #6: *Keira Padavil*

Majors: Mathematics, Physics

Faculty Advisor: Dr. Aart Verhoef

Synergizing Machine Learning with Cavity-Enhanced Vernier Spectroscopy for Molecular Fingerprinting

Cavity-enhanced Frequency Spectroscopy (CE-FCS) is a powerful method for broadband, high-sensitivity detection of volatile organic compounds (VOCs). The vernier technique can be applied to CE-FCS by filtering transmitted cavity modes to enable simplified spectral analysis while maintaining the same sensitivity. This combined method is known as Cavity-Enhanced Frequency Comb Vernier Spectroscopy (CE-FCVS). However, converting raw video output into quantitative absorption spectra requires complex and computationally expensive post-processing. This creates a bottleneck limiting the potential for real-time analysis and large-scale clinical deployment. The synthesis of machine learning may provide a reliable and timely solution. In this work, I investigate the use of machine learning to directly map CE-FCVS videos, trained on 1200-frame GIFs, to parameter labels such as free spectral range (FSR), bandwidth, comb width, center frequency, and intensity at each wavelength. I present a hybrid neural network architecture that combines a convolutional neural network (CNN) for feature and label detection with a U-Net–based convolutional architecture for spectral reconstruction. Preliminary results demonstrate highly accurate label detection using the CNN model. Development and optimization of the U-Net reconstruction network are ongoing, with the primary obstacle being the output video frame resolution relative to the extremely narrow widths of the absorption peaks. Even without the robustness of the U-Net model, label information and basic absorption shape are reliably obtained with existing models, thereby shortening the pipeline from output to usable spectra for analysis.

Poster Session 5 3:30 PM-4:30 PM CT
Room C

Poster #7: *Ashwin Sanjay*

Major: Computer Engineering

Faculty Advisor: Dr. Raffaella Righetti

Learning-based Out-of-Plane Motion Correction in Ultrasound Imaging

Ultrasound imaging is highly important due to its safety, portability, and ability to acquire real-time measurements in the field. However, ultrasound imaging currently faces significant challenges with measurement reliability when there is probe motion during acquisitions. Current image processing technique has robust solutions to effectively address in-plane motion, but out-of-plane (OOP) motion remains a significant challenge, because when the imaging plane itself shifts between frames, anatomical structures can appear to deform or even vanish, causing signal decorrelation. This reduces the effectiveness of tasks like tissue tracking, longitudinal analysis, and volumetric reconstruction. This research involves a pairwise learning-based approach to addressing OOP motion in ultrasound where relative transformation between frames is predicted, represented as a 6-DOF (degrees of freedom) pose representation. The main focus is to effectively quantify uncertainty, remain robust against noise, and and address imaging artifacts by avoiding overfitting and overconfident predictions, because overconfidence can be costly in medical settings and thus risk management is highly important. Particularly, this work aims to address current challenges with OOP motion without specialized hardware or changing current acquisition processes by utilizing machine learning. The model is trained and evaluated against controlled-acquisition ultrasound sequence datasets. Relevant benchmarks and metrics are utilized to assess the accuracy and validity of the pose predictions by the model along with the improvements resulting from corrections based on the model's predictions.

Poster Session 5 3:30 PM-4:30 PM CT
Room C

Poster #8: *Lakshya Vason, Caleb Parker, Matthew Jacquin, Adam Mulvey*

Major: Electrical Engineering, **Major:** Electrical Engineering, **Major:** Electrical Engineering, **Major:** Electrical Engineering

Faculty Advisor: Dr. Prasad Enjeti

Intelligent Data Acquisition System for Predictive Maintenance and Fault Detection in Power Electronic Circuits

Power electronic circuits are essential in modern energy and industrial systems, enabling efficient power conversion in applications such as renewable energy, electric vehicles, and motor drives. Because these systems often operate under fast switching and high stress, they require continuous monitoring to ensure safe operation, to maintain performance, and to reduce downtime. This project presents an Intelligent Data Acquisition (iDAQ) system, a modular platform that combines real-time sensing, embedded processing, and AI-assisted analysis to support condition monitoring, fault detection, and performance optimization in power electronic applications. The iDAQ system collects key electrical and thermal measurements from a target circuit and processes the signals in real time using an embedded controller. The resulting data stream is then analyzed by an AI inference engine that can identify abnormal operating behavior, support predictive fault classification, and provide insights for optimizing power electronic systems. To improve flexibility, the software architecture supports both device inference for low-latency responses and cloud-based reasoning for more advanced diagnostic capabilities. A web-based user interface displays live measurements, system status, and AI-generated interpretations to help users quickly understand circuit behavior and respond to faults. Current development emphasizes improving predictive accuracy, strengthening the connection between sensor data and AI reasoning, and expanding the system's ability to generalize across different converter topologies and operating conditions. By integrating real-time data acquisition with AI-driven diagnostics, the iDAQ system aims to enable scalable, low-cost predictive maintenance, reduce troubleshooting time, and improve operational reliability for power electronics deployments ranging from solar farms to electric vehicle subsystems.

Poster Session 5 3:30 PM-4:30 PM CT
Room C

Poster #9: *Adeolayemi M. Bamgbelu*

Major: Computer Engineering

Faculty Advisor: Dr. Jason O'Kane

Multi-Agent Classification using Implicit Models

Classifying agents using sparse, noisy sensor networks becomes significantly more challenging when you have multiple agents moving through an environment simultaneously. As sensor observations from different agents become interweaved, a data association problem of determining which data belongs to which agent becomes an challenge that must be solved alongside classification. When false positive detections, missed observations, and measurement noise are accounted for, additional uncertainty is added to the problem. This thesis addresses this problem of multi-agent classification by integrating implicit agent models with Markov Chain Monte Carlo (MCMC) sampling techniques to jointly associate observations with individual agents and classify their behaviors in accordance to their movement behavior. These implicit models define agents through simulation rather than explicit probability distributions, allowing for a flexible representation of complex movement patterns. The approach described in this thesis, uses edit distance calculations to compare observed sensor sequences against simulated trajectories generated from the implicit models, while MCMC sampling explores the space of possible observation-to-agent assignments that are then used to fully classify our agents. The results demonstrate the feasibility of extending implicit model classification frameworks to multi-agent scenarios and have potential applications in surveillance systems, wildlife monitoring, and other fields where multiple entities must be tracked and classified using a distributed sensor network. In doing so, this thesis presents a promising approach for multi-agent tracking in environments where sensor data is sparse and imperfect.

Poster Session 5 3:30 PM-4:30 PM CT
Room C

Poster #10: *Lillian Mitchell*

Major: Computer Engineering

Faculty Advisor: Dr. Jeyavijayan Rajendran

Evaluating LLM-Generated Masked Hardware for Side-Channel Security

This work looks at methods for improving the capability of large language models to generate side-channel-secure masked Verilog hardware through automated validation and model training. Designing side-channel resistant hardware is challenging and requires advanced to do, resulting in a scarcity of masked hardware examples. To address this limitation and reduce side-channel leakage in LLM-generated designs, we developed an automated pipeline that prompts a large language model to generate Boolean-masked Verilog modules from unmasked designs and validates outputs using formal leakage assessment. Generated circuits were evaluated using PROLEAD, a statistical side-channel leakage assessment tool, to detect first-order leakage under randomized input simulations. Designs that passed leakage tests were kept for dataset curation, while failing designs were analyzed to identify common structural errors and inform improved prompting strategies. Results demonstrate that while large language models can generate syntactically correct masked Verilog, many naive generations exhibit side-channel leakage due to incomplete masking, improper randomness usage, or incorrect register placement. By incorporating automated leakage evaluation and iterative feedback, we successfully curated a verified dataset of first-order leakage-free modules. This curated dataset was then used for preliminary model training experiments to assess whether fine-tuning improves generation of secure hardware designs. This framework demonstrates scalable approaches to reducing side-channel vulnerabilities in LLM-generated hardware through both inference-time validation and specialized model training.

Poster Session 5 3:30 PM-4:30 PM CT
Room C

Poster #11: *Brady Nguyen*

Major: Computer Science

Faculty Advisor: Dr. Shuiwang Ji

Asymmetric Memory Evolution for Multi-Agent Algorithm and Code Design

The use of Large Language Models (LLMs) for automated algorithm design and code generation is rapidly shifting from single-agent setups to more complex multi-agent collaborations. While these multi-agent systems offer significant efficiency gains, they currently face a major limitation known as "Imitation Collapse." In standard frameworks, agents share their successful findings freely. This leads to a feedback loop where agents stop exploring unique paths and instead mimic the high-performing peers, causing the system to homogenize and converge prematurely on suboptimal solutions. To address this critical issue, we propose Asymmetric Memory Evolution (AMEvo), a novel framework that regulates how agents share information. Instead of full transparency, AMEvo introduces an asymmetric update mechanism that balances the need for cooperation with the need for individual diversity. The system operates on two core principles: Failure Socialization and Success Privatization. Through Failure Socialization, agents broadcast their errors to the group, allowing the collective to "prune" the search space and avoid repeating known mistakes. Conversely, Success Privatization allows agents to keep their winning strategies to themselves. This prevents the group from rushing to copy a single solution, thereby safeguarding heuristic diversity and encouraging broader exploration. We validate AMEvo across a variety of challenges, including classic combinatorial optimization and complex scientific discovery in both geometric and discrete spaces. Our results demonstrate that by strategically controlling information flow, AMEvo effectively prevents redundancy and significantly boosts the system's collective search capabilities.

Poster Session 5 3:30 PM-4:30 PM CT
Room C

Poster #12: *Walker Johnson*

Majors: Applied Mathematics, Physics

Faculty Advisor: Dr. Artem Abanov

Analytic and Computational Insights into Skyrmion-Antiskyrmion Dynamics

Skyrmions, and their "anti-particle" anti-skyrmions are nontrivial two-dimensional magnetic textures which exhibit quasi-particle-like behaviors. Skyrmions have been shown to be stable in various conditions, range in size from 1nm-100nm and can be manipulated with significantly smaller current densities than traditional magnetic domains. At this scale, magnetic dipoles are subject to both classical and quantum interactions, which are evaluated in the continuum limit. These energy terms include, the Zeeman energy, the Exchange energy, the Dzyaloshinskii-Moriya (DMI) energy and the Anisotropy energy, which once minimized yield skyrmion quasi-particles as a stable minimum. Their size and low power requirements make them an ideal candidate for future memory and logic devices. With such promising applications on the horizon, it is imperative that the full scope of Skyrmion-Antiskyrmion dynamics are explored. Skyrmion dynamics can be explored via multiple different methods, including current-induced and field-induced dynamics. These mechanisms include additional energy terms into the equation resulting in damping, spin-orbit (SOT) and spin-transfer torque (STT) contributions. This presentation explores the dynamics of interacting skyrmions through both computational and analytical approaches. By approximating the magnetic textures as piecewise-linear, one can explicitly calculate the energy terms associated with these micromagnetic textures yielding insights into their dynamics. Such solutions are only approximate, and must be compared to computational models to evaluate their accuracy under a variety of material parameters.

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Room C

Poster #13: *Marie-Clotilde Laurent, Mackenzie Copfer*

Major: Kinesiology, **Major:** Kinesiology

Faculty Advisors: Dr. Carisa Armstrong, Dr. Christine Bergeron

The Comparison of Lower Leg Strength in Collegiate Pointe Dancers and Non-Pointe Dancers and the Effect on Balance and Ankle Stability and Alignment

The purpose of this study was to determine the effect of calf and ankle strengthening exercises on pointe dancers vs. non-pointe dancers. The research aimed to measure which dancer yields greater strength and technical improvement through creation of a calf and ankle strengthening workout plan for the participants to perform. The experiment would be implemented twice a week for four weeks with the participants divided into two groups, pointe dancers and non-pointe dancers. Analyzation of results would be through strength, balance, ankle range of motion, and technique. Data would be collected at the beginning of the intervention period and at the end through pre and post testing. Participants were asked to perform two single pirouettes, each one recorded and analyzed to identify misalignments. The movement provides a measurement of lower leg strength and technique as it involves a balance with one leg in passé. The findings may offer valuable insights into dancer strength and technique while potentially decreasing risk of injury.

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Room C

Poster #14: *Bhargav Ram Ravipati*

Major: Manufacturing & Mechanical Engineering Technology

Faculty Advisor: Dr. Mathew Kuttolamadom

Performance Analysis of Tungsten Carbide–Cobalt Tools in Rock Machining

This research investigates the performance characteristics of tungsten carbide–cobalt (WCCo) cutting tools used in rock machining applications, with the primary objective of improving tool durability and cutting efficiency through systematic optimization of tool properties, cutting parameters, and geometric configurations. Rock machining in mining, drilling, and construction industries needs the use of highly durable tools capable of withstanding harsh abrasive and mechanical stresses. However, these tools wear out quickly, which reduces productivity and increases costs. The study uses mechanical tests along with controlled rock cutting experiments performed at varying cutting speeds, feed rates, and cutting depths. Both normal and WCCo cutting tools are tested under the same conditions to make a fair comparison. WCCo tools are created using additive manufacturing (3D printing) to allow precise control over tool composition and structure. The research examines how both tool types wear during cutting and measures their cutting efficiency by tracking factors like tool wear, cutting speed, and material removal rate. By comparing normal tools to WCCo tools side by side, this research aims to identify which tool type performs better for cutting different types of rock and to determine the advantages and disadvantages of each tool in rock drilling applications.

Poster Session 5 3:30 PM-4:30 PM CT
Room C

Poster #15: *Jaelyn K. Rodriguez*

Major: University Studies

Faculty Advisors: Dr. Sheila Kitchen, Dr. Aki Ohdera

Just a Pigment of My Imagination?: Uncovering the Role of Carotenoids in Symbiont-Driven Metamorphosis of *Cassiopea xamachana*

Uniquely upside-down, the *Cassiopea xamachana* is a benthic jellyfish and valuable model organism for animal-photosymbiont mutualisms, where the holobiont is directly connected to the host's life cycle development and metamorphosis. In these jellyfish, the presence of a dinoflagellate endosymbiont directly triggers metamorphosis from the asexual polyp to the adult sexual medusa. This developmental transition is called strobilation. If these symbionts are not present, the symbiotic Cassiopea will remain as an asexual polyp indefinitely. This distinctive relationship between host and symbiont has been studied extensively, however, the true molecular underpinnings of how this pair triggers metamorphic expression is uncertain. Past fundamental research on closely related jellyfish within the shared Scyphozoan class have identified retinoid transcription factors and carotenoid-derived ligands as the major orchestrator of the downstream developmental cascade. Interestingly, these chemical inducers for strobilation are insufficient to induce the transition in Cassiopea alone, but are still highly expressed. These other cues found in non-symbiotic relatives are no longer available Cassiopea, leading the organism to adapt to a new cue - one we attribute to the presence of the symbiont. This study will complete a gap in the understanding of Cassiopea symbiosis, and delineate the retinoic and carotenoid-linked metabolic pathways that control strobilation into adulthood. By viewing into the dynamics of retinoic transcription factors with the paired host genes, we can solidify what mechanics are active in metamorphosis when a symbiont is present. Through understanding the life cycle dynamics of a symbiotic, metamorphic organism, specifically the ligands and molecular cascades that control expression of major developmental changes, we can reveal valuable answers within developmental ecology.

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Room C

Poster #16: *Anthony Shatby*

Major: Computer Science

Faculty Advisor: Dr. Thomas Ioerger

Comparative Analysis of Positively Selected Genes in Mycobacterium tuberculosis With and Without Diabetes Comorbidity

After the decline in global COVID-19 prevalence, tuberculosis (TB) has once again become the world's leading cause of death from a single infectious disease. Tuberculosis is known to increase the risk for other conditions, such as malnutrition. Similarly, many conditions, such as HIV or COPD, are known to increase the risk of contracting tuberculosis. Diabetes is another such condition, as patients with diabetes have been observed to have higher rates of contracting tuberculosis, as well as higher mortality rates once contracted. Previous studies have analyzed entire genome sequences of TB clinical isolates to look for genetic markers associated with various clinical impacts, such as drug resistance, transmissibility, and association with comorbidities such as HIV. This study examines differences in Mycobacterium tuberculosis genome mutations between isolates and identifies genes under stronger positive selection in patients with diabetes compared to those without diabetes. Analyzing genetic mutations, particularly by identifying genes under positive selection, is a common approach to identify proteins, and potentially biological pathways, whose disruption can lead to changes in the evolutionary fitness of an organism. Gene selection can be quantified by calculating a gene's dN/dS (or ω), a metric reflecting the relative rate of nonsynonymous to synonymous mutations in the gene. This study utilized GenomegaMap, which calculates dN/dS for genes using a Bayesian model of sequence evolution. Comparing dN/dS values between the two groups, multiple genes showed elevated dN/dS values in patients with diabetes when compared to those without diabetes, indicating differences in selective pressures between these two patient populations. These findings suggest potential variation in host environment, immune defense, or metabolic conditions that drive distinct adaptations in M. tuberculosis in patients with diabetes.

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Room C

Poster #17: *Sanuja Manage*

Major: Chemistry

Faculty Advisor: Dr. Wenshe Liu

Recombinant Expression and Purification of the Leukemia-Associated AF9 Protein

Oncogenic fusion proteins caused by chromosomal translocations are a frequent precursor to acute leukemias. One such example is the fusion of the mixed lineage leukemia (MLL) gene and AF9 (ALL1-fused gene from chromosome 9). This fusion interferes with standard transcription regulation and can lead to leukemogenesis. The AF9 protein is therefore the protein of interest for this project. X-ray crystallography is a structural investigative technique that requires an abundance of pure protein for proper analysis. Therefore, the purpose of this work is to express and purify an abundance of soluble AF9 using recombinant Escherichia coli BL21 cells. This structural characterization is valuable to identify binding pockets that can potentially be exploited by inhibitors as therapeutic options for leukemia. The protein was purified using Nickel-Nitrilotriacetic acid (Ni-NTA) affinity chromatography and SEC, which exploited the His-tag on the AF9 and its smaller hydrodynamic volume, respectively. Sodium Dodecyl Sulfate–Polyacrylamide Gel Electrophoresis (SDS-PAGE) was used to confirm the successful expression and purification (both after Ni-NTA and after SEC) of AF9. The collected protein over several cycles of successful expression was then concentrated, aliquoted, and flash-frozen to compile protein for downstream applications, including X-ray crystallography. This work establishes a successful workflow for AF9 protein purification and expression required for future inhibitor-binding studies relevant to leukemia therapeutics.

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Room C

Poster #18: *Surav Dhar*

Major: Bioenvironmental Sciences

Faculty Advisor: Dr. Julie A. Howe

Influence of Soil Cations on the Stability of CA2+ Mediated Organic Carbon Associations With Ferrihydrite

The formation of organo-mineral associations has been widely recognized for its key role in protecting carbon in terrestrial soils. The presence of cations in these systems has been studied as a process benefiting organic matter stabilization through forming bridging complexes. The positively charged ions bind to negatively charged minerals and organic matter, creating aggregates that influence soil structure, nutrient retention, and mobility. This research investigates the stability of calcium bridges between organic carbon and 2-line ferrihydrite in the presence of other cations (K+, Mg2+, Na2+, NH4+), found in the soil environment. Ferrihydrite, an iron oxide mineral, is environmentally important as iron oxides have a high reactivity and sorption capability for organic carbon. This study uses glucose as the pure carbon source due to its ease of use and accessibility. To observe such interactions, a variety of sorption and desorption studies were conducted, as well as a selectivity series and isotherms. Most of the literature highlights the formation and presence of calcium bridging; however, it is unknown whether such complexes are stable enough to have long-term impacts on mitigating global climate change. The results of this research could provide insight into calcium-mediated MAOC as stable or labile forms of soil carbon, and impact how landowners manage their soil health.

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Room C

Poster #19: *Neshini Sathishkumar*

Major: Physics

Faculty Advisors: Dr. Krista Lynne Smith, Dr. Jake Miller

Understanding the Corona of the Narrow-Line Seyfert 1 Galaxy 1H 0323+342 (Honey)

Active galactic nuclei (AGN) are accreting supermassive blackholes that emit bright jets and winds and play an important role in black hole growth and galaxy evolution. In this project, we study the source of optical variability in the AGN of the galaxy 1H0323+342, which is nicknamed Honey. We analyze approximately 3 months of observed data, taken in five filters by the Two-meter Twin Telescope (TTT). Our goal is to see if the corona is present and causing the varying optical emission, or if it is caused more by the jet, or even potentially a combination of both. To begin our analysis, we use astrometry to add WCS coordinates to our observations, then create light curves for each filter. Following this, we use PyCCF and PyROA to measures the time delay between the g-band light curve and the corresponding light curves in the r, u, i, and z filters. This allows us to make a curve-fitted plot of the time lags and analyze the resulting trends. While the analysis is ongoing, we expect that the varying optical emissions are primarily caused by the AGN's jet rather than the corona. This result would support the classification of Honey as a blazar and that the unusual positioning of the galaxy is what led us to believe otherwise.

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Room C

Poster #20: *Zilu Cheng*

Major: Economics

Faculty Advisors: Dr. Chelsea Strickland, Dr. Sarah Zubairy

Federal Reserve's Information Effect on the Housing Market

While previous papers have discussed the Federal Reserve's information effect on equity prices and other investments, this paper examines whether the tone of the Federal Open Market Committee statements affects U.S. housing activity by shaping consumer confidence and income expectations, as reflected in housing sales. To isolate the informational component of the monetary policy, I collected every FOMC statement from January 2011 through December 2024 and applied a textual analysis to convert the language of each statement into a quantitative sentiment index that can be examined with respect to other periods. Then, because housing decisions evolve with expectations and are sensitive to shifts in economic conditions, the analysis employs monthly data within a local projection framework that accounts for both contemporaneous relationships and dynamic responses over time. In other words, to isolate the influence of new information, this model controls for lagged sentiment and key macroeconomic variables, including the federal funds rate, inflation rate, and unemployment. This approach enables a clearer identification of how changes in the Fed's communication, independent of rate changes, propagate through the housing market. Overall, the results indicate that shifts in the tone of the Fed communication have a statistically significant effect on the housing market activity. These effects are not immediate; instead, they emerge with several months of delay. This lagged response is consistent with the slow-moving nature of housing decisions, including mortgage applications, financing adjustments, and other steps throughout the home-purchasing process.

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Room C

Poster #21: *Ethan Curb, Andrew Bae*

Major: Computer Science, **Major:** Computer Science

Faculty Advisor: Dr. Shreyas Kumar

A Study of Prompt-Based Bias Mechanisms in LLM-as-Judge Evaluations

Understanding whether large language models (LLMs) are truly reliable is a broad and increasingly important research problem. It spans accuracy, consistency, fairness, and stability under small prompt variations, all factors that influence how LLMs behave in real-world settings. Because this question is too large to answer directly, this study adopts a targeted and highly relevant modern context as a lens: LLMs acting as judges over paired answers. This scenario appears in model evaluation pipelines, automated grad-ing prototypes, and reinforcement-learning systems, making it a realistic anchor for studying reliability. We convert the broad reliability question into a concrete and experimentally manageable one: Do surface-level presentation fea-tures, tone, formatting, verbosity, structure, or lexical variation, bias an LLM judge's correctness decision when the underlying con-tent remains the same? To investigate this, we introduce a simple, extensible taxonomy of 11 bias mechanisms across five families, along with a fully reproducible and modular evaluation harness that enables systematic testing, replication, and future expansion. Using 540+ objective and 20 semi-objective pairwise evaluations, we observe that the model's overall accuracy remains high (95.2% on objective items), with most mechanisms introducing minimal or slightly positive changes. Nonetheless, we identify scattered answer-flips, mechanism-specific weaknesses, and early signs of order sensitivity. These results highlight that although the model is generally robust in this setting, LLM judges are not perfectly stable, and subtle biases can still exert influence. The main contribution of this work is not a singular performance finding but a methodological framework that narrows an otherwise unbounded question into a focused, repeatable experiment. The taxonomy, datasets, and harness are intentionally designed to be transparent, modifiable, and easy for others to extend, providing a structured foundation for deeper, more adversarial, or more domain-specific future research on LLM reliability.

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Room C

Poster #22: *Elaine Broussard*

Major: Psychology

Faculty Advisor: Dr. Joshua A. Hicks

What A Man Can Be: Evaluating Non-Moral Passions and the Experience of Authenticity within the Integrity-Fluency Model

Previous research on perceptions of the true self and authenticity has largely emphasized morally valenced activities or traits. Does engaging in non-moral passions, particularly harmonious passions, also foster authenticity? The Integrity-Fluency Model (IFM; Hicks et al., in press) posits that two cues, self-integrity (i.e., acting consistently with deeply held values) and experiential fluency (i.e., ease in a situation), elicit the feelings of authenticity. In this study, participants will be randomly assigned to one of three conditions in which they will reflect on and write about a harmonious passion, obsessive passion, or a simple routine (control), followed by a series of measures of authenticity and relevant constructs. We hypothesized that those in the HP condition would rate state authenticity and self-integrity higher than those in the OP and control conditions. We were agnostic about the effects of condition on experiential fluency. We also expected an indirect effect of self-integrity, such that it mediates the relationship between condition and subjective authenticity. Results revealed that the OP condition rated authenticity, self-integrity, and experiential fluency significantly lower than those in the HP and control conditions. Self-integrity was found to significantly explain the relationship between condition and subjective authenticity. This study contributes empirical support for the IFM and extends the understanding of authenticity to non-moral domains, an area lacking currently in the literature.

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Room C

Poster #23: *Jolee Szafran*

Major: Agricultural Leadership & Development

Faculty Advisor: Dr. Summer Felton Odom

Leadership Faculty and Students' Perceptions of AI in the Classroom: A Pilot Study

Artificial intelligence has become a rising, burning topic in many aspects of daily life, including those of the professional world, as well as academia. Platforms such as Gemini, ChatGPT, and multiple other generative AI creators have dominated discussions in and outside of the classroom. With the increasing conversation of artificial intelligence, there are lingering questions of the seeming ethical implications, how new platforms can be beneficial for their users, what are the pitfalls are presented with the creation of new platforms and technologies, and how do we keep up with the ever-changing and rapid publication of technology at this capacity. This study aims to examine the held perception of leadership faculty and students from differing institutions when using and teaching AI. By dissecting the categories and levels included in the diffusion of innovations model (Roger, 1962), we can see where modern-day and upcoming leaders stand in terms of adoption when it comes to artificial intelligence. By understanding how this population views the implications, expected outcomes, and current use of artificial intelligence, we can conclude how others outside of the discipline of leadership view artificial intelligence and how AI can be modified to better serve the realm of education and its users.

Undergraduate Research

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