2024 Shapiro Showcase Abstracts

Session I: Tuesday 4/9, 9:15 am - 10:45 am in the Kyle Morrow Room, Fondren Library

Anuska Santra

Developing a Y-Chromosome Based Sex Sorter to Determine Neural Circuits

Mentor: Dr. Herman Dierick
School of Natural Sciences

Separating males from females for experiments with Drosophila melanogaster is normally done by sorting them under a microscope with a paintbrush based on their morphological differences. The aim of my research is to simplify this sex-sorting strategy by placing drug resistance and drug sensitivity markers directly on the Y-chromosome. This allows us to select for or against males by feeding the population a drug to which males are resistant or sensitive. To make these transgenic constructs, I am using Goldenbraid 2.0 to combine the selection and counterselection marker with a physical marker (green or red fluorescence expressed in the eyes) into a cassette situated between two inverted attP sites. To make these transgenic males, I am using Crispr/Cas9 genome editing to introduce the markers in different regions of the Y-chromosome to increase the likelihood of obtaining a transgenic event. The Y-chromosome is very heterochromatic, which could make an integration event unobservable due to suppression of marker expression. To mitigate this, I treated flies with a drug that relaxes heterochromatic DNA and targeted regions where endogenous Y-chromosome genes are expressed. In initial experiments, I used two plasmids: 1) containing the Cas9 cDNA and a single guide RNA, and 2) containing a left and right homology arm surrounding the three markers. After injections of the two plasmids into embryos, I was unable to isolate any transgenic events from more than 100 fertile crosses with males that were injected as embryos. To increase the likelihood of obtaining a successful transgene insertion, I combined all the components for Crispr/Cas9 genome editing into a single plasmid. Once we obtain a successful integration, I will test flies with the drugs to either select for males or against males to test whether selection and counter selection work. In the future, I will switch the cassette out with different combinations of selection and counterselection factors using the PhiC31/attP/attB system to examine which selection and counterselection markers are most efficient as sex sorters. Here I present the result of my ongoing selection and counter selection Y chromosome transgenesis.

Adam Leff
Geographic Implications of Seismicity Associated with the 2018 Kilauea Eruption

Mentor: Dr. Juli Morgan
School of Natural Sciences

In May 2018, the Kilauea volcano on the big island of Hawaii began to erupt along the East Rift Zone. This volcanic activity abruptly ended in mid-August. The initial eruption was accompanied by several large earthquakes and a period of intense seismic activity. While the eruption ended in mid-August, the associated seismic activity continued through September to varying degrees. The seismic activity associated with the eruption has been documented in papers others; however, the exact locations of the earthquakes have not yet been determined and the geologic implications of that activity has not yet been thoroughly explored. Therefore, we do not understand their implications for the volcano's subsurface structures, particularly with regards to the offshore portion. By plotting the earthquakes with depth, magnitude, and time we have been able to identify several interesting features along the onshore and offshore portions of Kilauea volcano which are in keeping with the previously predicted subsurface structure of the flank of the Kilauea volcano. By comparing data from several sources which have collected seismic information from both onshore and offshore monitoring stations and relocating the earthquakes picked, we intend to analyze the geological and topographic implications of these interesting events and gain a more complete understanding of the active offshore structures of the Kilauea volcano.

Sam Nance
Polymer Core Flooding

Mentor: Dr. Sibani Lisa Biswal
School of Engineering

I am using polymer salt brine solutions to flood Berea rock core for enhanced oil recovery. It can be difficult to recover oil from inside smaller pores of rock. Attempts at pumping water and or gas through the pores to recover oil has issues of viscous fingering due to the low viscosity of water and gas. By creating a solution of water brine with polymer, the viscosity is increased, decreasing mobility and increasing the oil recovery - as long as polymer does not adsorb onto the core and block flow. This research focuses on analyzing the effectiveness of different polymer solutions for recovering oil and avoiding adsorption onto the core surface.

Rijuta Vallishayee
Performing Identity: Opera Bans as Qing Dynasty Governance of Social Identity, 1647-1912

Mentor: Dr. Jaymin Kim
School of Humanities

The many regional traditions of Chinese opera reached peak popularity during the Qing Dynasty (1636-1912). Why would the Qing government promulgate bans on its performance? This work seeks to understand the Qing governance of opera between 1647 and 1912, ultimately concluding that the point of cultural governance during the Qing period was to govern the performance of certain social identities, including ethnicity, gender, and morality, to maintain the stability of the empire. The Qing government frequently asserted that the practice of watching and performing opera was antithetical to properly performing the Manchu ethnicity, due to the key role that Manchu ethnic sovereignty played in maintaining Qing legitimacy. Additionally, Qing regulations aimed to extend the separation between sexes into opera performance to enforce the proper performance of femininity and preserve the physical and spiritual health of male officials. Finally, prohibitions directed at the provinces initially aimed to actually regulate the performance of morality, but became a pretext for disseminating historical narratives that would justify the Qing dynasty's legitimacy. Overall, cultural governance during the Qing era was a means of regulating the performance of social identity and reproducing authority for nearly three centuries.

Morgan McMains-Nurisio
Crimmigration, Criminal Labeling, and Executions: The Media's Portrayal of Executed Foreign Nationals Over Time

Mentor: Dr. Christina Diaz
School of Social Sciences

This study elucidates how criminal and non-citizen identities interact to produce public prejudice and is guided by the following research questions: In the modern era of the death penalty (1976-present), does mainstream media coverage of executions portray cases differently depending on the nationality of the person being executed? Is this difference stagnant over time, or does it change, and if so, how? Every foreign national executed in the U.S. since 1976 was matched to a U.S. citizen based on their race, sex, and execution date, yielding a total of 31 case pairs (n = 62 cases) for which news articles (n = 326) were scraped from several online databases. Each article was coded for variables relating to its political context, tone, information about the case, framing of the defendant's nationality, and treatment of broader social issues. Coded data was analyzed for trends and themes, both between the groups of foreign nationals and U.S. citizens and over time. Findings reveal that media coverage of executions varies significantly between foreign national cases and U.S. citizen cases and is changing over time, specifically regarding the tone and depth of coverage as well as the treatment of broader social issues.

Jaylin Vinson
Mami Wata: Uncovering Heritage Through Opera

Mentor: Dr. Karim Al-Zand
School of Music

"Mami Wata: Uncovering Heritage through Opera" is an original 20-minute chamber opera that centers on the Afro-diaspora mythological figure, Mami Wata, with an immersive and interactive narrative. The central aim of this project is to introduce opera, with its unique storytelling prowess, to audiences who may not have had prior exposure to such cultural experiences. Drawing inspiration from the captivating afro-diasporic folktale of Mami Wata, the chamber opera explores the interactions of the Goddess of the Sea. Within its narrative, Mami Wata possesses an extraordinary ability to reveal individuals' true identities by uncovering their ancestral lineage. As the story unfolds, Mami Wata encounters a prince on the brink of ascending to nobility. Believing in his virtuous family legacy, the prince is shaken when Mami Wata exposes the violent and exploitative origins of his family's rise to power. Faced with this unsettling truth, the prince must navigate the tension between his past, his present identity, and the choices that will shape his future. Through this chamber opera, we question the power and individual weight of origins, identity, and heritage.

Jason Han
Turning Quantum Noise on its Head: Using the Noise for Diffusion Models to Generate Images

Mentor: Dr. Tirthak Patel
School of Engineering

Generative image diffusion models have rapidly grown in popularity and utility in recent years. A key component of the diffusion model is the noise addition process, which is typically performed via pseudo-random generation. Previous work has explored how different sources of random noise affect diffusion models, with noise from quantum computers being a promising candidate due to parallel and true noise generation. Although noise from quantum computers are typically seen as errors, we adopt a different perspective to use quantum noise as a source of random noise in diffusion models. We propose an image diffusion model framework, Quantum Image Noise-based Generative Diffusion Models (QINGDM), that embeds images into quantum circuits to capture noise from quantum hardware. When comparing our method with classical noise on the MNIST handwritten digits dataset, we see that QINGDM had improved quality and diversity of generated images across 9 out of 10 digit classes. These results suggest that quantum noise allows for improved image generation and can be further explored.

Session II: Tuesday 4/9, 11:00 am - 12:30 pm in the Kyle Morrow Room, Fondren Library

Phoenix Orta
Cattle on the Border of New Spain: Faunal Analysis of Mission Dolores de los Ais

Mentor: Dr. Mary Prendergast
School of Social Sciences

Mission Dolores was an 18th century Spanish mission on the northeastern border of New Spain in present day San Augustine, Texas. As one of the East Texas missions, it was distant from other Spanish strongholds and situated within a diverse network of connections amongst the French settlements at Natchitoches and indigenous groups like the Caddo. Little is known about life at these missions, or how they interacted with other groups in the area. This research presents a novel zooarchaeological analysis of the faunal remains recovered from Mission Dolores during archaeological excavation in the 1970's to gain new insights into foodways at this mission. Identifying the type of animals eaten and signs of butchery can reveal more about the conditions and activities at this unique frontier site of Spanish colonialism. At this mission in particular, a dependence on cattle for meat is even more pronounced here than at other similar Spanish missions. Visualizing the cut marks present on the cattle bones using 3D models can further explore butchery patterns at the site, how the meat was portioned, and how it relates to comparable 18th century colonial sites in North America.

Galio Guo
AeroForge: Velocity-Based Metal 3D Printing

Mentor: Dr. Ricardo Zednik
School of Engineering

The field of additive manufacturing, or 3D printing, is one of the fastest growing industries for its significant advantages in rapid synthesis of unique components. As this technology has improved, it has expanded to encompass a wide range of materials, notably including metals. However, the most popular methods currently rely on heating metal particles to temperatures that detrimentally affect the metal's mechanical properties. These methods are also time-intensive and severely limit the types of components that can be produced. Over two semesters, eight engineering students collaborated to design a metal 3D printing device that uses the cold spray technique to build material into a desired shape. Rather than melting metal, the cold spray process accelerates metal particles at such high velocities that they weld to one another. By preventing the metal from melting, parts can attain much higher strength than traditional metal 3D printing methods, and in a fraction of the time. Cold spray has only recently been applied to additive manufacturing, and there are many areas for growth and improvement—most notably in device cost and mechanical design. This project aims to serve as a proof of concept for cold spray as an affordable and effective additive manufacturing technology.

Lily Scholnik
Reproductive Governance in Post-Cold War Latin America

Mentor: Dr. Claire Branigan
School of Humanities

Reproductive governance refers to the use of laws, state programs, public opinion, and other means to control, influence, and monitor reproduction. In the Cold War era, fears of overpopulation and communism intertwined, resulting in several instances of overt reproductive control in the form of forced sterilizations and contraception in Latin America. In the post-Cold War era, global human rights conferences defined reproductive rights as human rights, and methods of control transitioned to less overt means. This work examines obstetric violence and public opinion as two such means of reproductive governance.

Yundi Yao and Liufei Zhu
Forest Recipe

Mentor: Zhicheng Xu
School of Architecture

The thesis explores forest materiality and collaborative building practices by human and nature for the restoration of forest ecological life cycle. Originally, all lives in California lived harmonically in a balanced forest life cycle. Indigenous people and all creatures adapted to the natural pattern, while benefiting from each other. Fire, as a natural phenomenon, removes the refuses and rehabilitates new growth. However, in recent years, California is experiencing serious unhealthy forest issues. Human activities such as logging and century-long governmental fire suppression policies disrupted natural forest life cycles, making it difficult for forests to self-recover. Meeks Bay specifically, due to the site's past forestry, is crowded with invasive lodgepole pine species, outcompeting native ones like jeffrey pine and sugar pine for nutrients.

We approach these challenges by innovative use of forest materials. Collecting from forest thinning, as well as peeled-off tree barks, hollow tree trunks, fallen tree branches, cracked pine cones, and shedded pine needles, we repurpose the materials into built forms with natural beings synergistically. We also plan to reintroduce prescribed burning, promoting forest regeneration and growth while acknowledging nature's integral role in design interventions. Therefore, human and nature co-create institutions for new recurrences and co-existence of lives.

Through co-creation, the project attempts to critique the fetish for perfection on architectural permanence and initiate discussions on decay. These institutions became an agency for the forest, manifesting in distinct states spanning different periods of times. They eventually become one with nature and disappear over time. Amidst the uncontrollable process of decay, we embrace the dichotomy of roughness and delicacy, of spontaneity and control, and of temporality and

permanence. The curation constructs a facilitative natural cycle while engaging with humans and nonhumans to continue writing the collective memory of the land and patches to the existing forest for an evolved ecological status.

Hannah Li
Characterizing the Effects of Tumor-Resident Lactic Acid Bacteria on Cancer Cell Metabolism

Mentor: Lauren Colbert
School of Natural Sciences

Tumor microbiota serve a key role in the tumor microenvironment. They interplay with immune cells to regulate local immunity, and modify cancer cell biology and resulting response to cancer therapies.

Using combined deep sequencing, immune profiling, and targeted bacterial culture of patient-derived cervical cancer swabs, we uncovered the presence of a cervical cancer-associated Lactobacillus iners (CC-L. iners) strain that was significantly associated with decreased survival in cervical cancer patients.

L. iners is an anaerobic, obligate L-lactate-producing bacterium typically found in the cervicovaginal microbiome. Unlike other lactobacilli, L. iners harbors only the L-lactate dehydrogenase (L-LDH) gene in its genome and can only produce the L-enantiomer of lactate used in mammalian cells and tumors. CC-L. iners differ from commensal L. iners through altered lactate signaling pathways encoded in key genes lacG, lacD, lacR, and lacA (abbreviated lacGDRA), as well as upregulated Warburg effect and glycolysis.

In CC-L. iners, the reversible L-LDH enzyme facilitates conversion between lactate and pyruvate, enabling efficient lactate shuttling to cancer cells via monocarboxylate transporters (MCTs), potentially supporting tumor growth across different environments. However, the exact mechanism by which tumoral bacteria exchange lactate with tumor cells remains unclear.

CC-L. iners induce chemoradiation resistance in cervical cancer cell lines through L-lactate production, displaying increased cell viability following chemoradiation in CC-L. iners and L-lactate treated cancer cells. RNA sequencing of CC-L. iners treated cancer cells demonstrate enriched expression in lactate signaling pathways, including reactive oxygen species (ROS)-induced cellular signaling and hypoxia-inducible factor 1(HIF-1) transcription targets.

Survival analysis indicated that lactic acid bacteria with similar lactate-signaling genes (lacGDRA) to CC-L. iners correlate with reduced survival across various cancers. I aim to extend our characterization of CC-L. iners by comparing cancer-associated lacGDRA bacteria with beneficial lactic acid bacteria, and ultimately identify key differences in lactate-mediated bacterial metabolism

that influence cancer development. Uncovering the role of lactic acid bacteria in inducing cancer progression and treatment resistance can help develop a new generation of microbiota-informed therapeutics.

Ethan Kelly, Antonio Crivello, Jordan Martin, Jonah Wagner, Darrell Good, Evan Dunbar, and Samatar Dalmar
Sea++: Autonomous Sailboats for Decentralized Cargo Transportation

Mentor: Dr. David Trevas
School of Engineering

Team Sea ++ is guided by our mission to design an eight foot, economical, zero-energy autonomous sailboat with advanced motion planning for efficient and rule-compliant navigation. Our team is pioneering decentralized cargo transport for a sustainable and cost-effective future.

Nikita Singh
A Landscape Analysis of Psychedelic Retreats Aimed at English-Speaking Consumers

Mentor: Dr. Amy Lynn McGuire
School of Humanities

Recent clinical trials have suggested that psychedelics may be used to treat conditions such as depression and PTSD, fueling a growing interest in these drugs by the public and a subsequent rise in organizations offering psychedelic retreats. However, no existing literature focuses on exploring the current landscape of such retreats. We conducted a landscape analysis to characterize psychedelic retreat organizations based on organizational type, retreat location, substances offered, and the length and cost of retreats. Information from the internet (i.e., from organizational websites) was collected for 298 organizations. Descriptive statistics including frequencies and means were calculated. Results indicate that most organizations advertised themselves as general wellness retreats, operated and hosted retreats outside of the US, mainly offered ayahuasca and psilocybin, and offered retreats that are between 1-2 weeks long with costs ranging from $20 - $500,000. Future studies should focus on exploring the accuracy of collected information, the relationship between psychedelic legality and retreat structure, and the influence of the medical system on retreat organizations.

Session III: Wednesday 4/10, 9:15 am - 10:45am in the Farnsworth Pavilion, Rice Memorial Center (RMC)

Evelyn Chiu

Expression and Function of Nephronectin during Early Ocular Development in Mice

Mentor: Dr. Peter Lwigale
School of Natural Sciences

During development, the extracellular matrix (ECM) provides structure and signaling cues for key processes, such as cell migration and proliferation, that are necessary during the formation of proper tissue architecture. Cornea development provides a perfect example of this process, as neural crest cells interact with ECM proteins for proper migration and cellular processes. However, the functions of ECM proteins can vary depending on developmental time and space, as well as holistically across different organisms. Here, we investigated the expression and function of an ECM protein, Nephronectin (Npnt). Recent research in avian corneas indicated that knockdown of Npnt reduced corneal thickness, but did not affect cell proliferation, suggesting that it mediates periocular neural crest (pNC) migration through interactions with integrin α8. Although many ECM proteins in murine development are well-characterized, the role of Npnt in the mammalian cornea remains largely unknown. Moreover, Npnt contains five epidermal growth factor (EGF)-like repeats, which have been shown to regulate cell proliferation during tooth development. Based on previous studies, we hypothesized that Npnt is expressed in the murine cornea during development and it positively regulates cellular migration and/or cell proliferation. To test this hypothesis, mouse corneas were collected at embryonic stages E12, E13, and E14, when pNC are migrating. Histological techniques were utilized to determine the expression of Npnt during these timepoints and to analyze differences between wild type and mutant corneas. Our results indicate that Npnt mRNA is expressed in the pNC and corneal epithelium and the protein is localized in the epithelial basement membrane and along the migratory pNC. Based on these expression patterns, we analyzed the corneal epithelium and neural crest derivatives. Our preliminary observations indicate that absence of Npnt did not affect corneal thickness, cell proliferation, and cell density, suggesting that Npnt may function differently in the mouse. Combined, these results may contribute to a larger investigation on the function of Npnt during corneal development. Elucidation of the function of Npnt signaling may provide useful insights into potential applications for wound healing and regenerative medicine.

Sumin Yoon
Gifted Care: Reconfiguring HIV/AIDS Caregiving in the Post-Treatment Era

Mentor: Dr. Eugenia Georges
School of Social Sciences

HIV/AIDS-specific hospices operated since the 1980s to provide compassionate end-of-life care to dying AIDS patients However, some continue to operate today. If life-saving treatments are available, why is there still an AIDS-specific hospice in 2024, when hospices help people die rather than live with chronic disease? For patients who enter the hospice with only about six months to live, how do some transform from dying of AIDS to living with HIV? What is so special about the care given at the hospice that some residents are biologically and socially transformed? Through ethnographic research, I propose a new form of care – gifted care – that not only assists residents with HIV/AIDS to die with dignity but biologically transforms some residents as they enter the hospice with acute AIDS but leave the hospice in good health.

Robert Heeter, Sahana Prasanna, Richard Chan, Archit Chabbi, Kevin Li, Anushka Agrawal
UroFlo: An Automated and Intuitive Continuous Bladder Irrigation System

Mentor: Dr. Sabia Abidi
School of Engineering

Continuous bladder irrigation (CBI) is a common procedure performed post-urological surgeries, affecting over 200,000 patients annually. These patients face a heightened risk for blood clots due to gross hematuria (blood in the urine). While the current CBI apparatus is functional, the procedure has significant limitations:

Due to the lack of standardized hematuria assessment methods, physicians rely on subjective observations to adjust saline inflow, leading to inconsistent treatment.
Manual monitoring by healthcare workers contributes to burnout and patient complications.

To address these challenges, we introduce UroFlo, an automated CBI device comprising five key components:

Hematuria measurement sensor: Calculates blood concentration using spectral sensor analysis.
Inflow rate control: Regulates saline flow through a tube compression apparatus using a linear actuator.
Volume & rate measurement: Dual weight sensors monitor saline and waste bag levels, predicting replacements.

Notification system: Alerts healthcare workers via alarms, lights, and SMS for abnormal conditions.

User interface: A web-based touchscreen consolidating patient data and allowing manual or automated control of saline flow.

Our device has the potential to save 40 million healthcare worker hours yearly, translating to approximately $1.1 billion in costs. This innovation represents a significant step towards modernizing urological care through advanced AI and automation technologies.

Caroline Leung
Effects of Anthropogenic Land Use and Climate Change on Soil Biodiversity: Implications for Predator-Prey Dynamics in a Warming World

Mentor: Dr. Matthew McCary
School of Natural Sciences

Soils are the most diverse terrestrial ecosystems, housing an estimated ~60% of all terrestrial species worldwide. Soil is also the lifeline for terrestrial life, allowing for the growth of plants that support ecosystems, recycling of critical nutrients, and filtration of groundwater. Despite the importance of soils, the characteristics of soil that control biodiversity are poorly understood. We hypothesized that ongoing land use and climate change may modify soil structure in ways that decouple predator-prey dynamics. To test this hypothesis, we conducted a six-week microcosm experiment where we examined how a common soil arthropod (Folsomia candida) and its arthropod predator (Dalotia coriaria) responded to three treatments of land-use histories (urban, agricultural, and grassland soil) and two temperature treatments (ambient temperature [25°C] and projected increase [29°C]). Results from the ambient temperature scenario indicate that the predator's presence decreased F. candida's abundance irrespective of land-use history. Land-use history only affected predator abundance. Under a warming temperature, we observed reduced arthropod abundance overall. Together, our results suggest that climate change could strongly alter soil food web interactions, with predators being especially susceptible to the changes in soil characteristics associated with land-use history.

M. Almazan
Parental Writes: How PFLAG Queers a Pamphlet

Mentor: Dr. Rosemary Hennessy
School of Humanities

How do you make a queer pamphlet? What does it mean to "queer" an existing one? This project was created to assist PFLAG Houston and its members create a new educational and contemporary art piece. We examined the issues of K-12 education and transgender rights in Texas and how these topics have intersected to create restrictive, suffocating, and grossly misinformed legislation. This project describes the goals, values, and emotional outcomes of the organization through archival research of PFLAG Houston's previous informational materials and interviews with members about

their experiences. This project resulted in a product that addresses current issues in Texas transgender legislation and what families can do to help their children as their identities become politicized.

Grace Andrews
X-RAY HIGHWAY

Mentor: Tania Tovar Torres
School of Architecture

X-RAY HIGHWAY investigates historical, political and social factors of Houston's transportation infrastructure through case studies drawn from a range of interdisciplinary sources. The project holds an "x-ray" to the pervasive, concrete "skin" of the highways, exposing the unseen displacement, segregation and destruction that have been - and continue to be - justified by their construction.

In light of current plans for highway expansion, which would widen and redirect I-45 into the path of 1,235 families, 331 businesses, and 5 houses of worship in Houston, X-RAY HIGHWAY presents a novel juxtaposition between institutional and communal modes of highway portrayal - the former of which is often from an aerial view and focused solely on the movement of car bodies. In contrast, the latter reveals social and psychological effects of highway infrastructure at the scale of human bodies, which is often disregarded by traditional forms of representation.

Just as an x-ray of a broken bone does not provide a solution, but instead a diagnosis, X-RAY HIGHWAY does not claim to be a design solution in itself. Instead, through a presentation, a visual timeline, and an interactive installation to be exhibited in the School of Architecture, the project represents the visible highways through what has been made invisible for their construction, inviting those who experience it to consider an alternate reading of the built environment.

(1) https://www.txdot.gov/nhhip.html

Session IV: Wednesday 4/10, 11:00 am - 12:30 pm in the Farnsworth Pavilion, Rice Memorial Center (RMC)

Anna Hsu

Comparing Low-Frequency Hearing Thresholds between Insert Earphones and Headphones in Ears with Tympanic Membrane Perforations

Mentor: Dr. Albert Park
School of Natural Sciences

Introduction: In pediatric hearing assessments, transducers, such as insert earphones and supra-aural headphones, are used to conduct audiometric tests. Previous research has shown that in patients with normal hearing, there is no significant difference in hearing thresholds measured by transducer type. However, for patients with middle ear abnormalities, such as ventilation tubes, hearing thresholds were worse when measured with insert earphones and may incorrectly show conductive hearing loss at low frequencies. The purpose of this study was to determine whether such differences may occur in children with tympanic membrane perforations.

Objective: Compare hearing thresholds at 250 Hz and 500 Hz in pediatric patients with tympanic membrane perforations (TMP) by insert earphones and supra-aural headphones

Methods: 30 children (<18 years of age) were prospectively enrolled into three groups based on the size of their TMPs (no TMP, <50%, ≥ 50%). Hearing thresholds were measured at 250 Hz and 500 Hz using RadioEar IP30 insert earphones and RadioEar TDH50s 3045 headphones for all participants and compared using paired t-tests.

Results: At 250 Hz and 500 Hz, hearing thresholds were significantly higher when recorded with inserts than with supra-aural headphones in pediatric participants with TMPs. At 250 Hz, thresholds obtained with inserts were 14.6 dB ($p < 0.01$) higher than thresholds obtained with supra-aural headphones and 8.0 dB higher ($p < 0.01$) at 500 Hz. The average differences in hearing thresholds by transducer type increased with larger TMPs by 0.5 – 6.1 dB, though not significantly ($p > 0.1$). Hearing thresholds were also statistically significantly higher when recorded with inserts than supra-aural headphones in participants without TMPs, but they were not clinically significant as the difference was only 3.3 dB ($p < 0.05$) higher at 250 Hz and 3.2 dB ($p < 0.01$) higher at 500 Hz.
Conclusion: Low-frequency hearing thresholds were higher when measured with insert earphones in all groups of patients with and without TMPs, which may falsely indicate hearing loss. A diagnosis of low-frequency hearing loss must be interpreted with caution when using insert earphones in participants with TMPs.

Sean Hamilton, Thomas Kutcher, John Reko, and Jimmy Dickantone
Extrafoveal

Mentor: Dr. Sabia Abidi and Dr. Gary Woods
School of Engineering

The Extrafoveal device, developed as part of Rice University's Smart Helmet project, is an innovative modular augmented reality (AR) system designed to enhance the situational awareness of military personnel in combat. This hands-free, non-intrusive device integrates seamlessly into the battlefield environment, offering warfighters critical information without diverting their attention from the mission. Comprising six key components— a single board computer, magnetometer and accelerometer, GPS module, peripheral LEDs, AR glasses, and eye-tracking hardware—the system is engineered to form three primary subsystems: Eye-Tracking and Computer Vision, Information Display, and Navigation.

Leveraging eye-tracking and computer vision technologies, the system allows users to navigate the information display with their gaze, effectively using it as a cursor. This enables the effortless selection and interaction with data, based on the user's focus, enhancing decision-making processes on the fly. The Information Display subsystem projects a heads-up display (HUD) that visualizes data from various subsystems directly into the user's field of view, ensuring information is conveyed clearly without disruption. Meanwhile, the Navigation subsystem employs GPS to delineate optimal routes, with visual guidance provided through the HUD. This comprehensive approach ensures that warfighters remain fully informed and oriented, augmenting their operational capabilities with unprecedented efficiency and precision.

R Sean Cartwright and Will Doherty
Momentum Based Algorithmic Trading

Mentor: Dr. Kevin Crotty
School of Business

We (R Sean Cartwright and Will Doherty) have spent this semester creating an algorithm to trade stocks weekly based on a number of momentum based factors. We use a random forest regression model to make predictions on returns for stocks and test a 50-50 long-short portfolio to (theoretically) remove market risk.

Huijun Mao
A Quantitative Examination on Time and Space in Modernist Literature

Mentor: Dr. Alden Sajor Marte-Wood
School of Humanities

This project aims to examine spatial and temporal patterns in modernist literature through Digital Humanities approaches, specifically, a three-fold methodology combining cultural analysis, close reading, and distant reading.

The modernist movement, which roughly spanned the period from 1880 to 1920, emerged amidst profound societal shifts. Multiple cultural theories characterize this era by highlighting shifting perceptions of time and space due to societal transformations. This project draws from Stephen Kern's book The Culture of Time and Space 1880-1918, starting with a thorough sociohistorical analysis on how phones, cinemograph, trains and other inventions influence different dimensions of time and space. The subsequent computational analysis is performed both at the level of a single book and across 100 literature work. By adopting two tagging tools, HeidelTime and BookNLP, I conduct temporal, event, and entity annotations. Combining closer reading and statistical patterns, I scrutinize key aspects that define modernist work on the textual level, including the close tension between the past and the future, the freedom of form, the globalization, the closeness of interpersonal space, as well as the speeding effect of language. Through this research, I endeavor to navigate the ongoing discourse between close reading and distant reading, underscoring the indispensable role of humanists in computational humanities research, which points towards a promising path for humanities scholars in the digital era.

Megan McDonald
Foodscapes in the Lone Star State: Exploring Food Access on Texas College Campuses

Mentor: Dr. Craig Considine
School of Social Sciences

1 in 3 college students and 13% of Texas households experience food insecurity, or lack of food access. Previous food security-related research utilized the 4 Approaches to Evaluate a Foodscape (4AEF) model by investigating spatial, social and cultural, behavioral, and systemic factors. However, foodscapes had yet to be assessed with a food access-specific framework, such as the 5 Dimensions of Access Interrelation (5DAI): availability, area, affordability, accommodation, and acceptability. In this comparative ethnographic study of 5 Texas universities, I combined the 4AEF and 5DAI models to measure and rank the 5 schools' foodscapes through a food access lens. Gathering data for 20 individual model components, I toured the 5 schools' foodscapes, conducted 18 interviews, and cataloged nearly 400 food providers. Using a weighted average ranking system from 1 (poor food access) to 7 (superior food access), the universities ranked: University of Texas at

Austin (4.4), Texas A&M University - College Station (4.25), Rice University (4.05), Texas Christian University (4), and Texas Southern University (3.25). Additionally, market conditions indicate that universities have the opportunity to manipulate the foodscape through food pricing, policy, nutritional value, and operations. Applying this foodscape model, students at other universities can deduce areas of concern for their campuses, create concrete goals to increase food access, and decrease the likelihood of future food insecurity.

Sydney Coldren
Constructing Malnutrition: Dams, Technoscience, and Food Aid in Cochabamba, Bolivia

Mentor: Dr. Gökçe Günel
School of Social Sciences

In the highland Indigenous community of Misicuni, Bolivia, malnutrition is a relatively new phenomenon. After construction began on the Proyecto Multiple Misicuni dam in 1998, the agricultural community that lived in water abundance for centuries watched as the rich ecosystem used for subsistence farming dried up, effectively creating a food desert. Since 2020, children in Misicuni have received donations of multivitamins and fortified powdered milk from international corporations, alongside fresh produce from small farms. These donations aim to provide all the essential nutrients missing from the children's diet while the land that historically provided these nutrients withers beneath their feet. Drawing on three months of ethnographic fieldwork at the Banco de Alimentos in Bolivia (BAB) that provides alimentary assistance and collects extensive medical data on the children in Misicuni, I aim to historicize the delocalization of foodways in Misicuni within a larger transformation in the social and scientific understandings of what it means to be nourished. Furthermore, as the children in Misicuni become part of a complex network of doctors, food bankers, and multinational corporations, these scientific means of alleviating malnutrition and tracking the success of the food bank's efforts sustain a new infrastructure of global philanthropy that further legitimizes the dam's existence. Through this analysis, I assess how a biomedical understanding of nutrition and a scientific approach to wellness naturalize malnutrition in Misicuni while obscuring the structural factors contributing to its endurance. Finally, I argue that BAB subverts the legacies of global philanthropy and extractive science through a recognition of past histories of dispossession and an affective attachment to the children's future.

Bibek Samal
Role of Platelets in the Development of Delayed Neurological Deficits from Stroke

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Microthrombosis (platelet aggregation) has been suggested as a major factor contributing to delayed neurological deterioration in patients after subarachnoid hemorrhage (SAH). However, experimental studies on the role of microthrombi in delayed deficits after SAH as well as their potential as therapeutic targets have not been investigated. Thus, this study aims to elucidate the potential aggregatory role that platelets have in SAH pathophysiology. Our hypothesis is that, following SAH, mice which develop delayed neurological deficits have a greater number of microthrombi than mice which do not develop delayed neurological deficits.