



Honors Program
COLLEGE OF LETTERS & SCIENCE
UNIVERSITY OF WISCONSIN-MADISON

2026 Senior Honors Thesis Symposium Abstracts

Friday, April 24, 2026

1:00 PM - 5:00 PM

Union South

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**AGARWAL,
Simran**

Majors: Economics,
Political Science

Effectiveness of Sanctions

Advisor: Lisa Martin

Thesis department: Political Science

Economic sanctions are a key instrument of diplomacy, intended to alter the behavior of states without the sender states having to resort to military conflict. However, sanctions have been debated regarding their effectiveness in achieving the goal. My goal is to examine whether sanctions can successfully achieve foreign policy objectives and under what conditions they are most effective. Understanding whether sanctions are successful can help future policymakers and states design more effective strategies to achieve foreign policy objectives and reduce the threat of war. Using a comparative case study approach, the study analyzes US sanctions imposed on Iran, the UK, and Venezuela. By evaluating indicators such as GDP, currency fluctuations, and trade flows, I assess whether sanctions contribute to behavioral changes. I find that sanctions are the most effective when supported by multilateral cooperation and when the target state lacks access to alternative economic or financial parties.

**ASHIQ,
Muhammad**

Majors: Computer
Sciences,
Mathematics

A Theoretical Analysis of Mode Interpolation Hallucinations in ODE and SDE Diffusion Inference Procedures

Advisor: Grigorios Chrysos

Thesis department: Computer Sciences

We theoretically study the hallucination phenomena in two canonical diffusion samplers: the stochastic Denoising Diffusion Probabilistic Model (DDPM) and the deterministic Denoising Diffusion Implicit Model (DDIM). We analyze the reverse ODE (DDIM) and SDE (DDPM) for a Gaussian mixture target, proving that after a critical time τ , (a) DDIM can become stuck on the segment connecting the two nearest modes and (b) the *stochasticity of DDPM* helps DDPM become unstuck from this region, thus avoiding hallucination. Our empirical validation verifies that DDPM has a significantly lower hallucination rate than DDIM when this region is entered. Building on our observations, we exhibit how using additional stochastic steps can help DDIM avoid hallucinations and offer new insights on how to design improved samplers.

BANG, Theo

Majors: Linguistics,
Spanish

Certificate:
Japanese

The Multilingual Gay /s/: How the /s/ is produced and perceived in Spanish-English bilinguals

Advisor: Rajiv Rao

Thesis department: Linguistics

In past studies, looking at both Spanish and English, the /s/ phoneme has been shown to have certain marked articulation that index "gayness" in those communities: Spanish having the /s/ fully realized in places where it is typically weakened (Walker et al., 2014), and English having an "over-articulated" /s/ with higher peak frequencies, and more negatively skewed distributions (Mack & Muson, 2012). With the importance of /s/ phoneme in both languages, this study attempts to see whether

those marked changes still stand true cross-linguistically for Spanish-English bilinguals. Through both production and perception tasks, this study finds that while the L1 /s/ characteristics stay pretty robust, in the L2, speakers are more likely to reproduce their L1 /s/, leading to potential miscategorizations on the perception side.

BARDE, Aarav

pH manipulation in NMR Spectroscopy using Protonated Merocyanines

Major: Biochemistry

Advisors: Chad Rienstra and Thirupathi Ravula

Certificate: Health Policy

Thesis department: Biochemistry

Many proteins operate in pH gradients determined by their conditions within biological systems. Emulating these conditions for NMR spectroscopy has been difficult. Conventional methods require extensive sample handling, leading to sample loss. Water-soluble pH modulators represent a step toward improving NMR workflows. Many different molecules have been identified as possible pH manipulators for this purpose. Protonated merocyanines (PCHs), or photoacids, are an example of such a molecule. This study identified one PCH that could be an effective candidate for pH manipulation. Determination was done through NMR spectroscopy and UV-Visible Light spectroscopy. The photoacid with solubility >100 μ M and pKa of 7.0 was appropriate for biological experiments. With a pH titration of a single sample, we demonstrated that photoacids are adequate for pH manipulation.

BELEAN, Tudor

Regeneration Enhancer Knock-In Drives Injury-Specific Expression of Pro-Regeneration Genes

Major: Biology

Advisor: Junsu Kang

Thesis department: Biology

Humans have little regenerative ability compared to other vertebrates, such as zebrafish. Humans and zebrafish share many orthologs for protein coding genes, making zebrafish an excellent platform to study regeneration. Although the presence of one or multiple genes can not fully explain the differences in regenerative ability across vertebrate species, several regulatory elements within vertebrate genomes, such as enhancers, have been characterized as being able to drive significant phenotypic change, including changes in regenerative ability. One previously characterized regulatory element is the lepb enhancer element, or LEN, which has been shown to stimulate gene expression in zebrafish hearts and fins in an injury-specific manner. Notably, LEN was able to increase the expression of a cardiac mitogen, neuregulin1. Using a transgenic reporter line, we demonstrated that LEN is compatible with the neuregulin1 promoter, showing enhancer activity specifically during caudal fin injury. Furthermore, using a LEN knock-in line, we demonstrated that despite driving neuregulin1 expression in the larval fin fold, LEN integration did not improve caudal fin regeneration in adult zebrafish. Ultimately, further research is required to determine if LEN integration can potentially rescue regenerative ability in zebrafish lines with impaired regeneration.

BELLO, Raquel

Majors:
Conservation
Biology, Spanish

Angler Release Rates in Freshwater Recreational Fisheries in the United States

Advisors: Zach Feiner

Thesis department: Conservation Biology

Recreational fishing accounts for a large part of the global fishing industry, influencing fisheries ecology, providing people with incomes and food, and supporting long standing culture and tradition. The decisions anglers make, such as whether or not to release their catch, play an important influence on the effects of fisheries on fish populations, including harvest intensity and the efficacy of management. Thus far, research on catch and release fishing in the United States has been limited either taxonomically or geographically, preventing a broad understanding of how catch and release preferences, and therefore the meaning and relationships between people and fish, may be changing across broader spatial scales or different fishery types. To address this knowledge gap, our study used the U.S. Inland Creel and Angler Survey Catalog to analyze release rates for 75 species across 22 states over five decades, a first at a national scale, predicting that release rates had increased over time. Consistent with our hypothesis, we found a significant increase in release rates overall (70% of populations), but with high variability in trends among species, states, and waterbodies. Our results suggest that the values and motivations of anglers may be shifting away from harvest, representing a significant change in angler attitudes and new challenges for fisheries management based on controlling harvest.

BENISH, Grace

Major:
Neurobiology

WNT and SHH dynamics bias human cortical interneuron subtype specificity in an MGE organoid model

Advisor: André Sousa

Thesis department: Neurobiology

In the human dorsolateral prefrontal cortex lies a subpopulation of somatostatin-expressing (SST+) cortical inhibitory interneurons. These cells exhibit human-specific post-transcriptional downregulation of SST while simultaneously expressing tyrosine hydroxylase (TH), the rate-limiting enzyme of dopamine. Due to its recent discovery and relative scarcity in the cortex, it is unknown how the SST/TH subtype undergoes developmental specification. Here, we perform an in vitro organoid protocol screen to pattern SST+, TH+ cortical interneurons from medial ganglionic eminence (MGE) progenitors, the developmental structure from which they originate. We vary the timing, duration, and concentration of morphogens Wingless-related Integration Site (WNT) and Sonic-Hedgehog (SHH) to bias cortical interneuron subtype fate. Our results indicate that higher concentration and earlier signaling of SHH produce the highest concentration of SST+ cortical interneurons, but we report few cells that express both TH protein and SST RNA across all conditions, indicating our patterned TH+ neurons are unlikely to belong to our subtype of interest. Nonetheless, this optimized protocol provides valuable insights for those in the scientific community interested in subtype specification of the SST inhibitory subclass as a whole.

BERNAT, Eliana

Major: Chemistry

Certificate:
Sustainability***Mixed Aqueous-Organic Solvent Strategy Enables Phase & Crystallization Control of High n 2D Tin Perovskites*****Advisor:** Song Jin**Thesis department:** Chemistry

Metal halide perovskites are promising semiconducting materials for next generation solar cells, LEDs, and other optoelectronic devices due to their highly tunable crystal structures. While most perovskites are lead-based, replacing lead with tin addresses toxicity issues and presents unique optoelectronic properties. However, tin perovskites are generally less stable than lead due to facile oxidation. We therefore focus on 2D perovskites, which have increased stability due to bisecting organic spacer cations. Perovskite single crystals are conventionally grown in hydrohalic acid, but this aqueous synthesis method can lead to phase control issues and poor crystal quality, and tin perovskite phases have generally been limited compared to lead. Here we show that using a mixed aqueous and acetonitrile solvent system leads to improved phase purity, higher n phases, and enhanced crystallinity for 2D tin perovskite single crystals. We investigate the coordination chemistry of our mixed solvent system and its mechanism of providing access to phase-pure higher n (quasi-2D) phases and phases not previously achieved. We demonstrated this mixed solvent system on 14 tin perovskite systems, including 4 previously unreported phases, demonstrating its universality between several stable spacer cations and common A cations. These crystals exhibited enhanced crystallinity and photoluminescence compared to crystals grown using the conventional method. This new mixed solvent method enables greater synthetic accessibility and enhanced crystallinity of high n-phase quasi-2D tin perovskites, paving the way for safer next-generation optoelectronic and solar materials.

**BLOMBERG,
Owen**

Major: Zoology

The endocast of *Parasuchus bransoni* with implications for wider *Phytosauria***Advisors:** Scott Hartman and David Lovelace**Thesis department:** Zoology

Phytosaurs are a group of Late Triassic archosauriform reptiles that bear a striking but superficial resemblance to extant crocodilians. Historical research has primarily focused on the external anatomy of phytosaur skulls, with few instances of internal morphological research. Recent advancements in computed tomography technology and applied methods have facilitated a new wave of investigation into the endocranial anatomy of phytosaurs without the need for destructive sampling techniques. Despite this increase in attention, the majority of phytosaur species are still without any form of endocranial description. *Parasuchus bransoni* is an early-diverging phytosaur from the western United States, and it is the only species of the genus *Parasuchus* without an endocranial description. Here I present the first description of the cranial endocast of a referred specimen of *Parasuchus bransoni* (UWGM 1978), including general architecture of the brain and surrounding structures. The endosseous labyrinth (inner ear) of UWGM 1978 appears more similar to the more basal phytosaur *Wannia scurriensis* than to the congeneric *Parasuchus angustifrons*. In addition, the morphology of a sinus within the roofing bones of the skull, described in

other phytosaurs as either the pineal body or dural venous sinus, is clarified. This structure is now believed to represent a portion of the paratympanic sinus system, which is plesiomorphic to archosaurs. These morphological characters may have taxonomic implications for *Parasuchus* and should be incorporated into future phylogenetic studies of Phytosauria.

CHANG, Gavin

Conditional Lethality Identifies Mitochondrial Complex I as the Primary Functional Target of Deguelin

Majors:

Biochemistry,

Computer Sciences

Advisors: Jason Cantor and Kyle Flickinger

Thesis department: Biochemistry

Deguelin is a derivative of rotenone that has shown efficacy in multiple cancer types. Our previous high-throughput chemical screens identified deguelin as a compound whose lethality varies with respect to nutrient availability. Here, we investigated conditional deguelin sensitivity in derivatives of a physiologic cell culture medium (HPLM) and a conventional cell culture medium (RPMI). Through this work, we identified Mitochondrial Complex I as the primary functional target of deguelin. Additionally, we traced this conditional sensitivity to differential metabolite availability between HPLM and RPMI. We then leveraged these drug-nutrient interactions to reveal intriguing perturbations of several metabolic pathways upon deguelin treatment. Together, our findings provide a basis for revealing new mechanistic insights into cellular metabolism and understanding how deguelin conditionally inhibits cancer cell growth.

CHAU, Renee

Survey of Heritage Chinese in Chicago Chinatown

Majors: Chinese,

Linguistics

Advisor: Joe Salmons

Thesis department: Linguistics

This study aims to investigate the linguistic diversity of Chicago Chinatown. The Chinese diaspora has historically settled in ethnic enclaves, however, evolving immigration patterns have resulted in different settlement and linguistic patterns. Pressures to assimilate towards mainland Mandarin Chinese and American culture has impacted these communities. The usage of heritage languages highly varies which this study aims to investigate. An online survey and follow up interview was utilized to collect data about language usage and attitudes. This was distributed to several organizations and community spaces within the Chicago Chinatown. This study aims to provide an updated understanding of how different immigration waves have interacted and the impact of assimilation from multiple sides.

CHIKODIKAR, Sukrut

An Empirical Analysis of Stochastic Online Conformal Prediction with Semi-Bandit Feedback

Majors: Computer

Sciences,

Mathematics

Advisor: Ramya Korlakai Vinayak

Thesis department: Computer Sciences

Online conformal prediction is a method to quantify confidence (providing confidence bounds or intervals) in predicting the uncertainty of outputs of black box

models over sequential input. Computing thresholds that achieve satisfactory coverage typically requires substantial labeled data which can be difficult to obtain. In this thesis, I will be discussing my implementation and empirical analyses on an online conformal prediction algorithm that dynamically learns a threshold given a fixed number of datapoint using semi-bandit feedback. I also design and run experiments verifying whether empirical behavior matches the claims and findings of the original authors of the algorithm. Initial findings indicate sensitivity to score probability distributions, cumulative distribution function estimates and supremum-based threshold updates. The findings offer insights into the potential applications of online conformal prediction algorithms to measurement and reduction of hallucinations in RAG-LLM systems and critical low-data domains.

CHUN, Spencer

Liang Qichao: the Mover and Shaker of modern China

Majors: Economics,
History

Advisor: Viren Murthy

Thesis department: History

Certificates:
Data Science,
Mathematics

Liang Qichao (1873-1929) is seen in China as one of the most influential Chinese modern thinkers of his generation. However, little is known about his true importance here in the United States. In my thesis, I argue that Liang Qichao's philosophy and work throughout his career laid the foundations for authoritarian governments to dominate the modern Chinese political system. Particularly focusing on Liang Qichao's remarks on the importance of preserving the independence and unity of the Chinese nation even at the expense of individual liberties for the people, as well as the need for the Chinese people to participate in civic affairs to generate a national consciousness, mandating that every Chinese citizen must be an active participant in the political system of China in order for the state to succeed. A particular historical example that will be used as a case study is Mao Zedong's Great Leap Forward.

COLLINS, Isadora

Analysis of a novel iron-sulfur cluster synthesis protein found in *Novosphingobium aromaticivorans*

Majors: Chemistry,
Molecular and Cell
Biology

Advisors: Tim Donohue and Avery Vilbert

Thesis department: Molecular and Cell Biology

Novosphingobium aromaticivorans is a gram-negative bacterium capable of metabolizing a wide range of aromatic compounds into aliphatic intermediates, enabling the funneling of heterogeneous lignin-derived biomass toward common metabolic products. This versatility can be harnessed via metabolic engineering to convert raw biomass into industrially relevant chemicals. While recent work has advanced our understanding of lignin depolymerization and downstream metabolism in *N. aromaticivorans*, the complexity of its metabolic network and the involvement of poorly characterized proteins complicate targeted genetic modifications. Therefore, characterizing proteins involved in lignin-associated metabolic pathways is critical for optimizing its metabolic activity. One such protein is Saro0194, an iron-sulfur (Fe-S) cluster protein encoded within the Saro locus of the *N. aromaticivorans* genome. The objective of this project is to analyze the activity of Saro0194 under anaerobic conditions. In this study, Saro0194 was expressed and purified under anaerobic conditions to enable downstream biochemical characterization. This purification

yielded sufficient protein for planned enzymatic activity assays and metabolomic analyses under oxygen-limited conditions. These efforts establish a foundation for elucidating the role of Saro0194 in anaerobic aromatic compound metabolism and support future metabolic engineering strategies aimed at lignin valorization.

DAI, Yibo

Majors:
Microbiology,
Molecular and Cell
Biology

Certificates:
Biocore, Data
Science

Mapping Germ Cell Development in the Sexual Planarian Schmidtea mediterranea Using Single-cell Transcriptomics

Advisors: Phillip Newmark and Melanie Issigonis

Thesis department: Molecular and Cell Biology

Germ cells are essential for all sexually reproducing species, yet the molecular mechanisms regulating their formation and development remain incompletely understood. The sexual planarian *Schmidtea mediterranea* offers an excellent model due to its remarkable ability to regenerate germ cells. To identify candidate genes involved in planarian germline development, I performed RNA interference (RNAi) to enrich for germline stem cells and somatic gonadal niche cells for better characterization of their transcriptomes, and conducted single-cell RNA sequencing to identify genes highly expressed in those cells. I then validated candidate genes' expression patterns using RNA in situ hybridization. Subsequent RNAi experiments will allow us to characterize candidate genes' functions in germline development. Ultimately, this transcriptomic atlas of sexual planarians will provide important insights into both intrinsic regulation and extrinsic signals of germline development.

DASIKA, Kaushal

Majors: Computer
Sciences, Political
Science

Certificates:
Mathematics,
Public Policy

Measuring the Potential of Artificial Intelligence to Assist Local Governance

Advisor: Alex Tahk

Thesis department: Political Science

This thesis in Political Science examines the potential of artificial intelligence to improve local governance through a case study of the municipal zoning laws of the City of Madison and Dane County, and the Wisconsin State Statutes they apply to. The research evaluates if large language models (LLMs) can accurately interpret zoning law at multiple levels of governance, and answer questions on regulations, with and without access to legal texts. It measures the extent to which AI systems generate hallucinated or inaccurate responses to gauge potential risks and limitations in a practical environment of policymakers and citizens. By combining technical evaluation using prompt engineering with context-specific testing, this research explores the capabilities of AI as a tool for policy makers at the local level.

DHOONDIA, Khadijah

Majors: Biology,
Global Health

Certificates:
Biocore, Science
Communication

A Scoping Review on Methodologies for Addressing Response Shift in Patient-Reported Outcome Measures for Cancer Survivors

Advisor: Randy Kimple

Thesis department: Biology

Radiation therapy for head and neck cancer (HNC) often causes permanent salivary gland damage, resulting in xerostomia (chronic dry mouth) and reduced quality of life (QoL). Patient-Reported Outcome Measures (PROMs) are essential for assessing

xerostomia, but their long-term validity may be affected by “response shift,” a phenomenon in which patients adapt by altering their internal standards or definitions of QoL. This scoping review will systematically map clinical methodologies used to assess or adjust for response shifts in PROMs among long-term HNC survivors. Guided by the Joanna Briggs Institute framework and PRISMA-ScR guidelines, a comprehensive database search will be conducted. Findings will clarify how response shift theory is applied in clinical research, identify gaps in current approaches, and inform future efforts to improve QoL measurement in survivorship care.

**DONALDSON,
Julia**

Majors: History,
Political Science

Certificates:
Criminal Justice,
European Studies

Cover Ups and Consequences: A Comparative Analysis of Postwar Accountability for Klaus Barbie and Wernher von Braun

Advisor: Brandon Bloch

Thesis department: History

In 1947, Klaus Barbie was recruited by the United States government to monitor the French, locate former Gestapo informants, and provide information about the German Communist Party. Despite the fact that he was a known Nazi war criminal, the American government employed Barbie and hid his recruitment from the press for almost 40 years. Moreover, Barbie was not the only Nazi party member that the U.S. employed at this time. In 1945, German scientist and former Nazi Wernher von Braun arrived in the U.S. as a participant in Project Paperclip, a controversial program that brought foreign scientists to America. He worked for the U.S. Army and climbed the ranks at NASA, where he propelled American scientific advancements for the next 27 years. Despite their horrific pasts, over one thousand former Nazis were recruited by the U.S. to compete against Russian scientists or to act as Cold War spies. This thesis identifies and analyzes the Nazi hunters, journalists, and governments that shaped the legal treatments and reputations of Klaus Barbie and Wernher von Braun. Furthermore, it argues that the actions of individual activists, rather than complicit government entities, led to Barbie's conviction in 1987.

**DONG,
Bingyixuan**

Majors: Computer
Sciences, Data
Science

Certificates:
Education and
Educational
Services,
Educational Policy
Studies

Enhancing Visualization in Computer Science Education Through AI-Powered Visual Generation

Advisor: Bilge Mutlu

Thesis department: Computer Sciences

With the recent rise of artificial intelligence, new possibilities for learning have emerged, enabling learners to engage with information through text, images, and video. While AI has been explored across various educational contexts, from automated grading to personalized tutoring, the role of AI image generation in computer science education remains largely underexplored. CS concepts such as algorithms, data structures, and system architecture are inherently abstract, and research consistently shows that visualization can significantly improve student comprehension of these topics. Through interviews with computer science instructors and teaching assistants, I identify key visualization challenges and design requirements. Based on these insights, I am developing VisualCS, a web interface that allows educators to generate custom visualizations for abstract CS concepts to support introductory CS students.

ERICKSON, Evie***From Literacy to Liberation: On the Intellectual Formation of Edward Said***Majors: History,
Philosophy**Advisor:** Jennifer Ratner-Rosenhagen**Thesis department:** History

Edward Said was born in Jerusalem in 1935. He moved to Cairo in 1947, then to the US in 1951, where he remained the rest of his life. Each of these moves were motivated by political instability. Said's life was that of an exile. Growing up under British colonialism, enduring occupation and then coming of age in the US, the tumultuous world Said lived in shaped the one he imagined. Best known for *Orientalism* (1978) and founding postcolonial studies, Said began studying literature and later became a leader in the struggle for Palestine. How did Said's training in literary studies influence his political activism? Said's conception of narrative, that is, a representation of one's experiences and the recognition one feels in them, remained consistent throughout and thus connects these changes. From his dissertation on Joseph Conrad to his work on Palestine, Said's intellectual trajectory can be defined by how he used narrative to understand his identity as a Palestinian American exile.

**GLONEK,
Anastacia*****The Increased Effect Brain-Computer Interface-Functional Electrical Stimulation Therapy has on Chronic Stroke Survivor's Upper Extremity Motor Function Gains with the Inclusion of a High Intensity Tongue Display Unit as Measured by the Action Research Arm Test***Major:
Neurobiology**Advisors:** Vivek Prabhakaran and Alexander Remsik**Thesis department:** Neurobiology

Stroke is one of the leading causes of long-term disability with considerable gaps in the field's knowledge regarding rehabilitation therapy for upper motor extremity function. Closed-loop brain computer interface-functional electrical stimulation (BCI-FES) therapy is commonly used for stroke survivors. However, stroke survivors seeking therapy showcase a plateau in recovery after 3-to-6-months post-stroke onset. Therefore, the tongue display unit (TDU) is beginning to be tested in concordance with BCI-FES therapy. For this study, participants were grouped by experienced TDU intensity, presented with a cursor task, and upon successful completion of the task, received stimulation by TDU in concordance with BCI-FES therapy. A matched pair design was used to calculate the difference in the action research arm test (ARAT) score between pre-intervention and post-intervention. Because the tongue has a large representation in the brain and has consistent electrical properties, it is an exceptional electro tactile display. This increases the participant's situational awareness when completing a trial. As a result, additional neural pathways are being used in rehabilitation, creating an increased opportunity for cortical reorganization. Therefore, it is hypothesized that the inclusion of TDU in BCI-FES therapy will increase the gains in upper motor extremity function beyond the 3-to-6-month critical period.

HAINES, Hunter***College Students' Views of Sexual Experiences: The Role of Rape Myths and Racial Stereotypes***Majors:
Neurobiology,
Psychology**Advisor:** Kate Walsh**Thesis department:** Psychology

This study examines how rape myth acceptance (RMA) and Jezebel stereotype endorsement (JSE) influence college students' perceptions of ambiguous, alcohol-involved sexual encounters. Undergraduate students (N = 624) read vignettes manipulating the woman's race (Black or White) in a heterosexual encounter, then reported on blame attribution for the involved parties. I originally hypothesized that greater RMA and JSE would independently and interactively associate with higher blame for the woman, particularly for Black women compared to White women. Results revealed that the interaction between RMA and JSE was insignificant across all conditions, indicating these beliefs operate independently. Crucially, diverging effects emerged based on the woman's race: RMA significantly predicted greater blame attributed to the woman regardless of her race, whereas JSE predicted greater blame only when she was a Black woman. Ultimately, these findings indicate that while rape myths establish a baseline of blame for all women, racialized beliefs (JSE) act as an additional penalty for Black women following ambiguous sexual encounters.

HERNANDEZ, Megan***Tracing the neuroplasticity across the auditory system following learning of non-native phonetic contrasts***Majors:
Neurobiology,
Spanish**Advisors:** G. Nike Gnanateja and Dhatri Sadholalu Devaraju**Thesis department:** Neurobiology

Our study will examine how native English speakers perceive and produce non-native phonetic contrasts over the course of multiple sessions to track the trajectory of neuroplasticity across the subcortical and cortical auditory pathways. Participants will be trained to perceptually categorize or vocally produce non-native Mandarin tone contrasts over 12 sessions. Scalp-recorded frequency-following response (FFR), a measure of synchronous sound-evoked neural activity will be used to track the neuroplastic changes across the auditory system. We hypothesize that neuroplastic changes in the auditory cortex precede subcortical changes depending on the level of proficiency in categorizing or producing the non-native contrasts. Additionally, we predict that our production learning group will experience neural changes earlier than our perceptual learning group. The overall purpose of this project is to investigate the impact of long-term perceptual and production training on neuroplasticity across the auditory system.

**HUDDLESTON,
Riley**

Major: Biology

Certificates:
Global Languages,
Culture, and
Education;
Global Health;
Health Policy***Establishing the Persistence of Natural Hyperandrogenism in Rhesus Macaques: Toward a non-Inductive Animal Model of Polycystic Ovary Syndrome*****Advisor:** Jenna Schmidt**Thesis department:** Biology

Polycystic ovary syndrome (PCOS) is one of the most common endocrine-metabolic disorders with various comorbidities; however, the pathogenesis remains incompletely understood, and is unlikely to be explained by one mechanism. Current treatment for PCOS therefore focuses on symptom management as growing bodies of research attempt to understand the basis for the syndrome. Animal models have become increasingly common in PCOS research, but most are imperfect, principally due to the lack of a non-inductive model. Inducing PCOS phenotypes, such as hyperandrogenism, is valuable, but does not allow for complete characterization of symptoms. The Wisconsin National Primate Research Center (WNPRC) maintains a population of naturally hyperandrogenic (HA) female rhesus macaques identified as possibly strong animal models for human PCOS. This project aims to track the persistence of HA and presence of other PCOS traits in this colony across two sequential menstrual cycles and/or anovulatory periods in order to confirm the macaque as an ideal, non-inductive model, and to reinforce the use of HA as PCOS diagnostic criteria. Methods include blood sampling and processing from naturally HA and control macaques and subsequent analysis of hormones and other analytes. At the time of thesis completion, available data will include testosterone levels, cycling regularity, complete blood cell counts, and chemistry panels.

HYDE, LauraMajor:
NeurobiologyCertificate:
Gender and
Women's Studies***Dynamic changes in Hox Gene Expression during Somite and Neural Tube Development*****Advisor:** Deneen Wellik**Thesis department:** Neurobiology

Mammalian embryonic development is when body pattern is established and all organs are formed. Hoxa5 is expressed in lung, neural tube, somites, diaphragm, foregut, midgut, and patterns the cervical-thoracic region of the axial skeleton while Hoxa11 is expressed in the neural tube, somites, and zeugopod during early development of the embryo. The dynamic changes in Hoxa5 and Hoxa11 expression during somite differentiation and neural tube patterning has yet to be determined. This study investigated Hoxa5 and Hoxa11 expression in mice at various time points between E9.5-E12.5 using whole-mount visualization and cryosectioning. Hoxa5 was observed throughout the sclerotome and hypaxial lip of dermomyotome contributing to proper vertebral formation, rib placement and fibroblast populations. Hoxa5 was also shown in precursor cells of the central nervous system and motor neurons which later become useful for innervating the diaphragm. Hoxa11 was observed in the somites present at the posterior end of hindlimb bud and into the tail as well as sclerotome progenitors for the proper formation of the sacral and caudal vertebrae and myotome progenitors necessary to pattern the zeugopod. Hoxa11 was also shown in precursor cells of the central and peripheral nervous system and motor neurons.

ITANI, ReemMajor: Political
ScienceCertificates:
Arabic Language
and Culture,
African Studies,
Educational Policy
Studies,
Middle East Studies***The Gendered Aspect of Forced Migration: A Comparison of Syrian Female and Male Refugees in Lebanon and Jordan*****Advisor:** Marwa Shalaby**Thesis department:** Political Science

This thesis examines the question "To what extent does the treatment of Syrian refugee women differ from that of Syrian refugee men in Jordan and Lebanon?" It argues that gendered outcomes differ between Lebanon and Jordan primarily due to variation in institutional refugee governance, which interacts with patriarchal norms to produce increased challenges for women in Lebanon. In Lebanon, women face discrimination based on their gender, experiencing a lack of access to sexual health resources, a shortage of permanent shelters, and increased unpaid domestic duties (United Nations Women, 2019). In Jordan, the influence of patriarchal authority, limited access to education, and safety concerns regarding sexuality are a few challenges refugees face (Nasser-Eddin, 2015). Although women undergo similar challenges, such as a lack of access to employment due to their duties at home and gender-specific healthcare, they differ in these two cases, as Lebanon's institutions for refugees, meaning refugee camps and other assistance, consist of less institutional support than Jordan's (United Nations Women, 2019; Lynch, 2017).

**JAKKIDI, Srujay
Reddy**Majors: Computer
Sciences, Data
Science***Decomposing Kubernetes Pod Startup Latency Under Bandwidth Constraints*****Advisor:** Remzi Arpaci-Dusseau**Thesis department:** Computer Sciences

When a Kubernetes pod starts up, time is split across several stages: scheduling, image pull, sandbox creation, and container initialisation. But which stage actually dominates, and by how much, is not well understood, especially when network bandwidth is limited. This thesis answers that question by instrumenting a single-node Kind cluster with two independent measurement surfaces (kubelet logs and containerd CRI events) that together achieve sub-millisecond precision, and by using Linux tc bandwidth shaping to systematically vary the network constraint. The key finding is striking: under bandwidth constraints, image pull accounts for 93% of total pod startup latency at the median, rising to 99% for large images under tight constraints. Pull latency follows a simple linear model, compressed image size divided by available bandwidth, with $R^2 = 0.95$ across 48 observations. A same-environment replication one day later confirms the model's slope within 0.1%, and an independent pre-pull experiment validates the result from the opposite direction: eliminating the pull stage drops startup from 75 seconds to 2 seconds. The practical implication is clear: for anyone running Kubernetes at the edge, across regions, or in CI/CD pipelines with limited bandwidth, image size is the single most important lever for faster pod startup.

KANNEL, Jeremy ***Investigation into the role of photorespiration and amino acid metabolism defects on TOR activity in Arabidopsis thaliana***

Major: Molecular
and Cell Biology

Advisors: Jacob Brunkard and Katie Klimpel

Certificate: Biocore

Thesis department: Molecular and Cell Biology

TARGET OF RAPAMYCIN(TOR) is a protein kinase that is conserved through all eukaryotes and is responsible for resource allocation during growth and development. The TOR pathway is understood well in animals, although it is not in plants. To elucidate this pathway further we are manipulating a gene, Fd-GOGAT1, which is usually responsible for glutamate formation and recovery. It performs these tasks by interacting with the wasteful byproducts of RuBisCo under photorespiration. Usually, RuBisCo reacts with CO₂, although it can interact with O₂ under low CO₂ conditions. Interacting with O₂ creates wasteful byproducts that are eventually processed through photorespiration. A mutation in FD-GOGAT1 causes changed leaf shape, smaller rosette size, and chlorosis and these developmental phenotypes are rescued when grown under high CO₂ conditions. Interestingly, this mutant also has hyperactive TOR activity. To determine if this hyperactive TOR activity is related to amino acid metabolism or photorespiratory processes, Fd-GOGAT1 will be exposed to different CO₂ conditions with phenotypic observations taken to quantify changes. Further, Western blots will be conducted for pT449-S6K to track changes in TOR activity. These efforts will elucidate certain functions of the TOR pathway in plants and whether they are related to photorespiratory processes or amino acid synthesis.

KE, Jiayi (Hebe) ***Determining the importance of Bet1L in skeletal muscle and its role in ALS pathogenesis***

Majors:
Neurobiology,
Pharmacology and
Toxicology

Advisor: Masatoshi Suzuki

Certificate:
Data Science

Thesis department: Neurobiology

Amyotrophic lateral sclerosis (ALS) is a progressive neurodegenerative disease characterized by motor dysfunction and muscle atrophy resulting from the loss of motor neurons in the spinal cord and brainstem. Although ALS has historically been considered a motor neuron disease, increasing evidence suggests that degeneration may occur in a retrograde manner, beginning in the periphery at the neuromuscular junction (NMJ). The Suzuki lab previously reported a vesicle trafficking protein, Bet1L (Bet1 Golgi Vesicular Membrane Trafficking Protein Like), as a novel molecule potentially linked to distal pathology in ALS. Our recent studies highlight the importance of muscle-derived Bet1L in NMJ maintenance and motor neuron survival. However, the specific roles of Bet1L in skeletal myocytes remain unknown at the cellular level. Here, I hypothesize that Bet1L plays critical roles in skeletal myocyte differentiation, function, and ALS-associated cellular pathology. To test this hypothesis, I will use skeletal myocytes derived from human induced pluripotent stem cells (iPSCs), including patient-derived iPSCs carrying the most common genetic cause of ALS, the C9ORF72 hexanucleotide repeat expansion. Bet1L function will be investigated using siRNA-mediated knockdown and AAV-mediated overexpression approaches. These studies will provide new insights into the role of Bet1L in ALS pathogenesis and neuromuscular degeneration.

KEYS, Siena

Majors:
Neurobiology,
Psychology

Certificate:
Sustainability

Promoting sustainable consumption through social norms messaging: An experimental test

Advisors: Benjamin D. Douglas

Thesis department: Psychology

According to social norms theory, individuals match their behavior to groups they identify with. Optimal distinctiveness theory suggests, however, that individuals will deviate from their group when their sense of uniqueness is threatened. The present study investigated whether insights from social norms theory and optimal distinctiveness theory could be used to encourage people to limit their clothing consumption and thus reduce their carbon footprint. Participants completed a task suggesting to them that they are either quite similar to (high need for distinctiveness) or rather different from (low need for distinctiveness) their peers with regard to various consumption habits. In addition, we unobtrusively exposed participants to information suggesting that either a small percentage (minority social norm) or a large percentage (majority social norm) of their peers are currently limiting their clothing consumption. We measured a variety of outcomes related to participants' clothing consumption, both immediately afterwards and one month later. Results contrasted our predictions, suggesting that identity salience rather than optimal distinctiveness, impacts social norms.

KOCHENY, Alexandra

Majors:
Computer
Sciences,
Geography

Resilience in the Great Lakes: A Comparative Analysis of Flood Resilience Planning in Mid-Sized Coastal Cities

Advisor: Asli Göçmen

Thesis department: Geography

Climate change poses an imminent threat to cities across the United States, requiring local governments and planners to prioritize resilience in their future development and various other plans. Existing literature on flood vulnerability primarily focuses on coastal communities on ocean shorelines, neglecting cities in the Great Lakes region that similarly face flooding risks based on the changing climate with expected storms in greater frequency and strength, as well as changing lake levels. This study addresses this gap by examining three mid-sized cities located on the shore of at least one Great Lake: Milwaukee, Buffalo, and Cleveland. Using the Plan Integration for Resilience Scorecard (PIRS) framework, the study assesses the comprehensiveness and cohesiveness of each city's relevant planning documents in addressing flood vulnerability. The findings suggest that, like larger cities, mid-sized cities incorporate policies to mitigate flood vulnerability and promote long-term resilience in their plans. However, the effectiveness of the planning efforts vary by city, with some demonstrating more comprehensive, cohesive, and equitable policies than others.

KUMBLE, Ashwini ***Remove, Replace, Refine: A Computational Approach to Improving Color Palettes for Data Visualization***

Majors: Computer
Sciences,
Psychology

Certificate:
Data Science

Advisor: Karen Schloss

Collaborators: Dr. Danielle Szafr (University of North Carolina-Chapel Hill), Dr. Lane Harrison (Worcester Polytechnic Institute), Dr. David Laidlaw (Brown University)

Thesis department: Psychology

Color plays a critical role in how we perceive and interpret data visualizations such as charts and maps. For example, a well-curated color palette can make charts visually appealing and easy to understand. But, what makes a palette more aesthetically preferable? This project investigates perceptual features that drive color palette preferences in data visualizations using behavioral experiments and computational modeling. Participants compared pairs of three-color palettes displayed in data visualizations and rated their preference on a continuous scale. A regression model built from lightness and hue features explained 70% of the variance in preference ratings. Results suggested that people preferred palettes where lightness was distributed more uniformly across colors and leaned toward cooler hues like cyan-green, while shifts toward warmer hues like orange were less preferred. To test generalization, we used the model to select palette modifications predicted to be preferred over their originals. New participants preferred the model-selected modifications in 19 of 22 cases, demonstrating that the model generalized to new palettes judged by new people. These findings both offer insight into how people evaluate color combinations in data visualizations and can be used to improve color palette recommendation tools used for data visualization (i.e., Colorgorical).

LAUTEN, Sofia ***Physics-Informed Neural Networks for Gate Design using Quantum Optimal Control.***

Major: Physics

Certificates:
Computer
Sciences,
Entrepreneurship,
Mathematics

Advisor: Matthew Otten

Thesis department: Physics

Implementing quantum gates on quantum computers can require the application of carefully shaped pulses for high-fidelity operations. We explore the use of physics-informed neural networks (PINNs) for quantum optimal control to assess their usefulness in predicting such pulses. Our PINN is a feedforward neural network that utilizes an unsupervised learning approach, whose loss function includes terms that enforce the equations that govern the evolution of a quantum system, measure how close the learned unitary is to the target unitary operation, and ensure state normalization. We use a sinusoidal activation function and adopt variance-type weight initialization, tailored to our activation function. By analyzing the model's performance with important machine learning metrics, we demonstrate that the choice of our architecture is well-suited for this type of problem. We ensure that our network avoids the vanishing and exploding gradients with our relevant choices. We build two different PINNs, one based on the Schrödinger equation and another one based on the Lindblad equation. Our PINNs are able to discover high-fidelity two-qubit gate pulses for a variety of quantum operations, demonstrating its flexibility and robustness.

LI, Oscar***Insights into Mechanisms of Ni-Catalyzed Cross-Electrophile Coupling Reaction***

Major: Chemistry

Advisors: Rashi Bhatnagar, Jieru Zhu, Shannon Stahl**Thesis department:** Chemistry

A significant class of Ni-catalyzed reaction, cross-electrophile coupling (Ni-XEC) has been noted for its ability to avoid the usage of a nucleophilic organometallic coupling partner. Meanwhile, selectivity becomes a rising challenge when using electrophiles as both coupling partners. Therefore, this study aims to investigate the mechanism of Ni-XEC and study its reactivity preferences. In the first project, we will explore the impact different reaction parameters can have on the relative rates of transmetalation versus oxidative addition of Ar-X to the Ni(II)-aryl intermediate and hence, on the dominant mechanistic pathway. Understanding the factors that favor one mechanistic pathway over the other can have important implications for Ni-catalyzed reactions that promote cross-coupling of aryl electrophiles over the undesired homocoupling. In the second project, we investigate how electrochemical methods such as chronoamperometry (CA) could be used as a kinetic tool by tracking passing of charge. We have obtained turnover frequency (TOF) data for these reactions which are conventionally inaccessible, and conducted potential dependence studies to reveal the nature of rate limiting steps.

LIM, Heewone***Quiet in the Library: The U.S. Information Service and Korean Student Resistance***

Major: Journalism

Advisor: Kathryn McGarr

Certificates:

Digital Media

Analytics, Folklore,

Political Science

Thesis department: Journalism

Student activism has long been a driving force in South Korean political movements. This project explores the intersection between Korean student protests, American foreign policy, and media framing, specifically examining how Korean perceptions of U.S. involvement in the 1980 Gwangju Uprising led to the occupation of the U.S. Information Services (USIS) library in Seoul in 1985. Mainstream American coverage of the protest privileged Western diplomatic voices and framed the standoff as a contained success, marginalizing the students' demands and obscuring the depth of anti-American sentiment their protest represented. Government-facing agencies like the FBIS, by contrast, produced more comprehensive accounts driven by the Cold War imperative to understand how America was perceived abroad. By examining competing narratives surrounding the USIS protest, this project seeks to reveal how information politics and student protest intersected during a pivotal decade of democratization, with implications for understanding international perceptions, media power, and grassroots mobilization.

LIN, Candie***Targeting EphA2 in HNSCC to Improve Tumor Immunogenicity***

Major: Biology

Advisor: Deric WheelerCertificates:
Data Science,
Statistics**Thesis department:** Biology

Head and neck squamous cell carcinoma (HNSCC), the sixth most common cancer, is a prominent health concern. Immunotherapy has become a promising treatment for HNSCC, particularly the targeting of the PD-1/PD-L1 pathway using immune checkpoint inhibitors; however, immunotherapy resistance has become a prevalent issue, frequently associated with immune exclusion and extracellular matrix (ECM) remodeling within the tumor immune microenvironment. EphA2, a receptor tyrosine kinase on cancer cells, has become a recent potential receptor of interest, as EphA2 is overexpressed in many cancer types including HNSCC. Many of these HNSCC patients with high EphA2 levels have poor overall survival, suggesting EphA2's involvement in tumor immunogenicity. This thesis assesses EphA2's role in HNSCC and tumor immunogenicity, identifying the EphA2-DDR1 signaling axis. A Luminex assay showed that there were different levels of anti- and pro-tumor cytokine secretion between vehicle and EphA2 overexpressed clones. Transcriptomic and immunohistochemical analyses of vehicle and ensartinib-treated tumors were used to determine that EphA2 does not increase proliferation rates but instead contributes to a pro-tumor environment by activating DDR1, a collagen receptor. These findings identify EphA2's role in immune exclusion and ECM remodeling in HNSCC, supporting the targeting of EphA2 as a therapeutic strategy to improve response to immunotherapy.

**LUNDSTROM,
Ann*****What Remains: Memory, Medicine, and the Role of Literature***Major: English
(Literature)**Advisor:** Raquel KennonCertificates:
Health Policy,
Teaching English to
Speakers of Other
Languages**Thesis department:** English

This thesis explores the interconnectedness of healthcare and narratives, specifically as it applies to memory loss and dementia. Physician and pioneer in the research of narrative medicine, Dr. Rita Charon, introduced the skill of listening to patient narratives through a literary lens to not only provide more effective medical care, but to also form deeper, more meaningful relationships with patients. Yet, what happens when that narrative fails? Patients who experience memory loss, such as dementia and Alzheimer's, many times lose the ability to situate themselves in the present and relay their feelings and experiences temporally to their medical providers. This thesis analyzes three novels that work with themes of memory loss: "Somebody I Used to Know" by Wendy Mitchell, "Piranesi" by Susanna Clarke, and "The Buried Giant" by Kazuo Ishiguro. By using narrative medicine techniques and concepts as a framework for approaching literary works—both memoirs and imaginative fiction—the literary works can become clinical examples in themselves. When applied to these three novels, this will expand on how memory loss both fragments the narrative foundation of medicine while reimagining different forms of narratives and how that shapes patient care.

**LUO, Guizhong
(Harry)**

Majors: Applied
Mathematics,
Engineering and
Physics;
Mathematics;
Physics

Certificate:
Integrated Liberal
Studies

A Qubit in an Oscillator: From Ideal GKP Codes to Energy-Scaled Error Mitigation

Advisor: Matthew Otten

Thesis department: Physics

Quantum error correction protects fragile quantum information by encoding it redundantly. The Gottesman-Kitaev-Preskill (GKP) code takes an elegant approach: it encodes a qubit in the infinite-dimensional Hilbert space of a single bosonic mode – a microwave cavity field – using a lattice structure in phase space. This thesis develops the theory of the GKP code along a narration from idealization to implementation. We begin with the ideal code's mathematical structure, then confront the two physical constraints: finite energy, which forces normalizable approximations with a squeezing parameter, and photon loss, the dominant noise channel in superconducting circuit QED hardware. We analyze how loss distorts the phase-space lattice and develop the recovery operations – both operational error correction and the near-optimal Petz recovery map – that attempt to restore it. Finally, we present energy-scaled zero-noise extrapolation (ES-ZNE), an error mitigation technique that exploits the GKP code's relationship between photon number and code performance to extrapolate noiseless expectation values from a ladder of finite-energy measurements.

LYONS, Arwen

Majors: History,
Legal Studies,
Political Science

Private Property Beneath the Fruited Plain: The Cold War Minuteman Missile Program and Military use of Eminent Domain on Tribal and Settled land.

Advisors: Allisson Useche Powers and Richard Keyser

Thesis departments: History and Legal Studies

The Minuteman missile program was a cold war deterrence program of ICBMs buried below the Great Plains. At its peak the region housed 1,000 underground active nuclear missiles. The placement of these missiles on private farms, tribal lands, and the military use of eminent domain brings together questions about property rights, militarism, and Cold War historical perspectives. This project asks the question: How does an examination of the resistance to and government use of eminent domain to acquire private land for the housing of Minuteman Missiles in the Great Plains and on the Fort Berthold Indian Reservation challenge conventional understandings of tribal sovereignty, and private property rights? My research investigates the day-to-day negotiations over land management and land acquisition with Great Plains farmers and Native members of the Mandan, Hidasta, and Arikara (MHA) federally recognized tribal nations in North Dakota through the use of multiple archives and various primary sources across the Great Plains. Bringing together legal and historical questions about property and government resistance is crucial for understanding our past and laying the groundwork for future intersectional alliances for environmental protection and fundamental freedoms.

MA, Rin***RAMP1 Knockout Predicted to Sensitize BRAF-Mutant Melanoma to Dual BRAF/MEK Inhibition by Restoring CD8⁺ T Cell Cytotoxicity***

Major: Biology

Advisor: Debpali SurCertificate:
Art Studio**Thesis department:** Biology

Therapeutic resistance to BRAF and MEK inhibitors limits long-term survival in BRAF V600E-mutant melanoma. Emerging evidence implicates neuroimmune signaling—specifically, calcitonin gene-related peptide (CGRP) released by tumor-associated sensory neurons and its receptor activity-modifying protein 1 (RAMP1)—in promoting CD8⁺ T cell exhaustion and tumor immune evasion. We propose to test the hypothesis that genetic ablation of RAMP1 in melanoma cells enhances the efficacy of combined BRAF (vemurafenib) and MEK (trametinib) inhibition by preventing CGRP-mediated immunosuppression and creating synthetic lethality within tumor cells. Using the clinically relevant murine YUMM1.7 melanoma model, we will generate RAMP1 knockout and control cell lines via CRISPR/Cas9 editing. We will then assess clonogenic survival and transwell migration under single and dual inhibitor regimens. We expect RAMP1 knockout cells treated with both inhibitors to show significantly reduced colony formation and migration compared to wild-type controls. Successful demonstration of this synergy would (1) validate RAMP1 as a predictive biomarker for targeted therapy response, (2) provide mechanistic insight into neuroimmune contributions to resistance, and (3) support repurposing FDA-approved CGRP receptor antagonists alongside BRAF/MEK inhibitors. Our interdisciplinary approach integrates cancer genetics, neuroimmunology, and pharmacology to address a critical barrier in melanoma therapy.

MALPANI, Rishit***Distributionally Robust Instruction Fine-Tuning (DRIFT) in Large Language Models***Majors: Computer
Sciences, Statistics**Advisor:** Jelena DiakonikolasCertificate:
Mathematics**Thesis department:** Computer Sciences

Instruction fine-tuning is the key process that makes modern AI Large Language Models (LLMs) helpful by teaching them to follow user commands. However, these models are often brittle as they can provide very different answers to prompts that mean the same thing but are phrased differently. This reveals a critical gap in their reliability. Current training methods focus on making the model perform well on average, but they fail to prepare the model for the worst-case scenarios of the most confusing, unusual, or poorly-worded instructions (the “difficult distributions of instruction style”). While recent instruction-tuning strategies have improved generalization and alignment, they have not yet addressed distributional robustness under a formal min–max optimization framework. This project proposes to develop the first Distributionally Robust Optimization (DRO)-based instruction fine-tuning framework for LLMs: Distributionally Robust Instruction Fine-Tuning (DRIFT). The goal of DRIFT is to explicitly optimize models for worst-case variations in instruction distributions, ensuring improved consistency and generalization to unseen tasks. The project will leverage open-source, non-instruction-tuned LLMs (e.g., Meta OPT-350M, LLaMA series) and open instruction datasets such as Databricks

Dolly-15k, which naturally lend themselves to categorical partitioning for DRO. Models will be fine-tuned using multiple optimization schemes: standard supervised fine-tuning (SFT), domain reweighting with minmax optimization (DoReMi) style updates, smooth log-sum-exponentiation DRO formulations, and dual-linear coupling min-max optimization updates. The training and experimentation pipeline will be executed using UW-Madison's CHTC HTCondor high-performance computing cluster to enable large-scale, reproducible experimentation across models and configurations. The resulting models will be evaluated on both quantitative metrics (loss and perplexity) and qualitative robustness via pairwise preference judgments from stronger LLMs, where the preference win rate of each model will serve as a practical measure of enhanced performance and relative robustness. Demonstrating consistent improvements over SFT and other methods' baselines will indicate the efficacy of distributionally robust instruction fine-tuning. This work introduces a new dimension of robustness into the instruction-tuning paradigm and represents a step toward making LLMs more reliable under diverse, real-world instruction distributions.

MANNA, Mihir

Majors: Astronomy-
Physics, Physics

Certificates:
Computer
Sciences,
Mathematics

Effect of Discussion Prompt Scaffolds on Argumentation by Introductory Physics Students

Advisor: Benjamin Spike

Thesis department: Physics

Students' success in physics depends not only on solving problems, but on justifying and evaluating scientific claims--a process known as argumentation. However, despite its importance, argumentation itself receives comparatively little attention in physics curriculum design. In this study, we developed a collection of worksheet problems for Physics 104 structured around the Toulmin argument pattern, a well-established framework for justifying a claim at varying degrees of sophistication. These worksheets were distributed to students throughout the semester and we measured their effect using attitude surveys, written exam problems, and semi-structured interviews. With hundreds of students enrolled in introductory physics each semester, we anticipate the final results of this study to have a meaningful impact across UW-Madison.

MARKEVITCH, Ellise

Major:
Neurobiology

Certificates: Global
Health, Science
Communication

Assessing gut microbiome diversity and composition in asthma and depression

Advisor: Melissa Rosenkranz

Thesis department: Neurobiology

Depression is a leading cause of disability worldwide, and asthma is a highly prevalent chronic inflammatory disease. The mechanisms driving these diseases are not completely understood, particularly around their co-occurrence. The gut microbiome has emerged as one system that may link peripheral immune and central nervous system function. To investigate this, I explored differences in gut microbiome diversity and composition between individuals with only asthma, only depressive symptoms, and both asthma and depressive symptoms. I found differences in alpha diversity metrics between groups. Additionally, using ANCOM-BC, I identified bacterial taxa that were differentially abundant in those with both asthma and

depressive symptoms compared to those with one condition. These results suggest that the gut microbiome may play a role in the comorbidity of asthma and depression.

MEIER, Kaitlyn

Majors: Human Development and Family Studies, Psychology

Certificate: Disability Rights and Services

Helping or Hindering: The Role of Caregiver Characteristics and Scaffolding on Children's Science Learning

Advisor: Martha Alibali

Thesis department: Psychology

Previous work has shown the importance of early science education and identifying factors that impact its quality (Junge et al., 2021). This study aimed to identify the relationships among caregiver characteristics, scaffolding, and children's learning outcomes during a science game. A sample of 27 caregiver-child pairs (M age of children = 6.9 years, SD = 1.1) were asked to play a simple card game focusing on the insect life cycle. Caregivers provided information about demographics and other characteristics (e.g., education level, science experience). Videos of gameplay were coded for caregiver scaffolding behaviors (e.g., open/closed-ended questions, emotional-motivational support), and children completed pre- and post-tests to measure learning. This study will help identify distinct caregiver characteristics and scaffolding behaviors that promote or inhibit science learning for children.

MERCER, Julia

Major: Neurobiology

Certificate: Health Policy

Higher Temperatures are Proposed to Increase the Frequency of Rhythmic Activity in Spinal Central Pattern Generator Cells in Larval Zebrafish

Advisor: David Ehrlich

Thesis department: Neurobiology

At warmer temperatures, larval zebrafish are proposed to demonstrate a higher frequency of activity in spinal central pattern generator (CPG) circuits that correlates with higher tail-beating frequency. Therefore, we aim to examine how spinal CPG circuits in larval zebrafish are affected by temperature. Larval zebrafish will be used as an animal model because they have similar motor circuit units to other vertebrates, including humans, and are transparent, making their neural structures easy to visualize and image. This study contributes to the growing data surrounding the neural correlates of movement and how they contribute to biologically relevant actions in certain species. Additionally, the data can be used to learn more about the motor circuits of other aquatic vertebrates in scenarios with changing temperature, e.g. global warming of water bodies. The cells that will be observed are V2a interneurons, located in the spinal cord, which have been shown to project to motoneurons (Eklöf-Ljunggren, 2012) and are marked with *chx10*, a transcription factor in the larval zebrafish we are using. This study will observe neural activity in the spinal cord and hindbrain as well as swimming behaviors with changing temperatures to develop evidence of a correlation between CPG activity and swimming.

MEYER, Marie

Majors: Global
Health, Religious
Studies

Tuberculosis Prevention as a Moral Obligation: An Analysis of the National Tuberculosis Association's Christmas Seal Campaign through a Religious Studies Perspective

Advisor: Susan Ridgely

Thesis department: Religious Studies

This senior honors thesis examines how the religious theories of Sally Promey and Michel Foucault illuminate the significant effectiveness of 20th-century tuberculosis prevention campaigns by demonstrating how these campaigns framed prevention as a moral obligation rather than a source of fear. While the anti-tuberculosis crusade in the United States was seemingly secular, it successfully mobilized Christian values and family-centered messaging to foster prosocial behavior and widespread public adherence, most notably through the National Tuberculosis Association's Christmas Seal campaign. This research conducts a historical analysis drawing on archival materials, public health campaigns, and visual media from the TB prevention movement. The religious theories of Promey and Foucault serve as a guiding framework, offering insight into how images, cultural memory, and systems of social surveillance significantly shaped public engagement with disease prevention. Furthermore, this methodology examines how appeals to communal values, moral obligation, and visible participation transformed tuberculosis prevention into a socially enforced practice, contributing to the campaign's long-term success.

MITZNER, Chloe

Majors: Journalism,
Political Science

Podcast Politics: Podcasts' appeals to Gen Z male voters

Advisor: Young Mie Kim

Thesis department: Journalism

This thesis will combine a quantitative and qualitative analysis of the use of podcasts in the 2024 Presidential campaign and the effect that it had on young Gen Z male voters. Specifically, I will be looking at the context surrounding the campaign and analyzing the correlation between the use of podcasts leading up to the election and the increased voter turnout among this demographic. The thesis will cover an in-depth coding analysis of all the podcast interviews conducted with Donald Trump in October and compare it with the content of the podcast interviews with Kamala Harris from October. My research will also entail interviews with Gen Z men who voted in the past election for Donald Trump and listened to the podcasts from the analysis. My hypothesis is as follows: If the Trump 2024 presidential campaign targeted Gen Z men through popular podcasts, then it led to an increase in political support and voting realignment among that demographic. In summary, over the course of last semester and this semester I have conducted research in order to answer my research questions and analyze the correlation between masculine centered podcasts interviewing Donald Trump during the 2024 campaign and Gen Z male voter turnout.

**MONTGOMERY,
Michael**

Majors: Biology,
Psychology

Relationship between poverty, pubertal timing, and neural reward processing in adolescents

Advisors: Seth Pollak and Rasmus Birn

Thesis departments: Biology and Psychology

One in seven children in the United States lives in poverty which has been linked to early puberty and can have adverse consequences for child development. This study examined how poverty and pubertal timing independently and interactively relate to neural reward processing in adolescents aged 12-15 using fMRI during the Monetary Incentive Delay task. Contrary to our primary hypothesis, poverty and pubertal timing were not associated with nucleus accumbens activation during reward anticipation. However, secondary analyses revealed that boys experiencing poverty showed greater neural differentiation between receiving positive and negative feedback in the putamen, caudate, and amygdala, regions involved in reinforcement learning, goal-directed behavior, and emotional salience. These findings suggest that growing up in poverty may influence how boys learn from reward outcomes with potential implications for decision-making and risk-related behavior. These results may reflect heightened sensitivity to receiving positive feedback, blunted sensitivity to negative feedback, or both. Further research into understanding these mechanisms can help inform potential interventions to support at-risk children.

**NELLORE,
Dharshita**

Major: Biology

Certificates:
Biocore,
Environmental
Studies

Apoplast, Apoplast! Which Apoplast Do You Like? - Biochemically Altered Apoplasts in Tomato for Xanthomonas and Pseudomonas

Advisor: Jeri Barak

Thesis department: Biology

Plants are often exposed to pathogens that biochemically alter the apoplast, which is the intercellular space filled with gas or water. Two such pathogens of tomato are *Pseudomonas syringae* (Pst) and *Xanthomonas hortorum gardneri* (Xg). Both bacteria create symptoms that appear macroscopically similar, but they have been observed to manipulate the stomata differently. We found that there is a difference in the metabolites found in the Pst- and Xg- infected apoplasts, suggesting different biochemical alterations within the plant during Pst and Xg infection. To further understand the differences these bacteria cause inside a leaf, we focused on how an apoplast that has been biochemically altered by Pst/Xg infection can impact the growth of Xg/Pst compared to their growth in a healthy apoplast. We found that Xg showed a higher growth rate in infected apoplasts, while Pst showed a higher growth rate in healthy apoplasts. Xg grown in the infected apoplasts has access to some unique metabolites, only found in infected apoplasts, that can be used in its metabolic cycles leading to its increased growth rate.

NETTER, Edison

Major: Biochemistry

Optimizing the Expression and Purification of the Core Replication - Transcription Complex from Mouse Hepatitis Virus

Advisor: Robert Kirchdoerfer

Thesis department: Biochemistry

Coronaviruses replicate their genomic material using a core polymerase complex comprised of nsp12, nsp7, and nsp8. While this machinery is well-characterized in vitro in other coronaviruses, like SARS-CoV-2, less is known about the laboratory model mouse hepatitis virus (MHV). MHV is a powerful coronavirus model because it is not known to infect humans, allowing the virus to be safely studied at BSL-2. Notably,

MHV nsp12 contains deletions relative to other coronaviruses, including a shortened nsp12-nsp8F interface loop which has shown to mediate polymerase assembly in other coronaviruses. These structural differences raise important questions about how sequence variation shapes polymerase function. Establishing a recombinant protein system of the core replication proteins will enable in-depth biochemical characterization through RNA binding and polymerase activity assays. Additionally, this system will allow for a structural work-up and targeted mutagenesis of the replication proteins, with those findings testable in parallel with live-virus studies. Current optimization efforts focus on co-expression of the core replication proteins and refining the purification using heparin affinity to capture nucleic acid associated protein. By reconstituting the core replication machinery in vitro, we aim to discover how species-specific differences shape polymerase function and to provide a toolkit for dissecting the molecular mechanisms of coronavirus replication.

OWENS, Howard ***The Role of Environmental Responsiveness in Infant Language Learning***

Major: Psychology

Advisors: Jenny Saffran and Ellie Breitfeld

Certificate: History

Thesis department: Psychology

Infants learn by tracking patterns in their environment. This process, known as statistical learning, is especially important for early language development. There is evidence that children differ in their statistical learning abilities; however, the factors driving these individual differences remain understudied. The current study investigates a novel explanation of individual differences in statistical learning: the responsiveness of an infant's environment. In our task, we manipulate the responsiveness of infants' environments based on their experience controlling a computer screen using their eye movement prior to a statistical learning task. For half of the infants, the screen responds to their eye movements (e.g., when they look at an image of a pond, a duck pops out). The other half cannot control the screen and see a recording of an infant in the responsive condition. Next, in the statistical learning task, we measure infants' ability to anticipate an upcoming word as they gain exposure to predictable adjective-noun pairs (e.g., "silly birdie" and "happy piggy"). We predict that infants who have the opportunity to control the screen will outperform those who cannot in the subsequent statistical learning task.

PENG, Zixuan ***On the Nature of Strings***

Major: Computer Sciences

Advisor: Remzi Arpaci-Dusseau

Thesis department: Computer Sciences

In real analytical data systems, string columns often dominate both storage overhead and execution cost. Based on our analysis on PublicBI, string data accounts for 81.5% of total bytes, and more than 52% of operations target strings. Existing Apache Arrow variable-length string arrays adopt a uniform offsets + data layout. Although this design offers strong generality, string-intensive operations still require accessing full string contents, making it difficult to fully exploit the distinguishable prefixes in real-world data. To address this limitation, we propose a new Arrow-oriented string array representation. We split each string into a fixed-length prefix + variable-length suffix format. All prefixes are stored contiguously and can be accessed directly, while

all suffixes continue to follow Arrow's organization, thereby preserving the current implementation path and access logic as much as possible. By colocating the most discriminative prefix bytes, our design enables the system to read more useful characters for decision-making in a single memory access, allowing pruning to be completed using only prefixes, and accessing the suffix region only when necessary. This work explores the possibility of restructuring in-memory layouts based on real-world string distribution, and provides a new system design direction for efficient representation optimization over large-scale real-world strings.

**PRADO NUNES,
Rayane**

Major: Psychology

Certificates:
Dance, Gender and
Women's Studies

When do children stand up to bias? Investigating children's responses to race-based exclusion

Advisors: Kristin Shutts and Eren Fukuda

Thesis departments: Psychology

In this study, children aged 5 to 10 years viewed stories featuring a protagonist who made playmate selections. In one condition, the protagonist systematically selected same-race playmates and excluded other-race peers; in the other condition, no racial pattern was evident in the protagonist's choices. All participants then completed a pattern-encoding task to assess whether they detected race-based exclusion. Next, participants: (1) evaluated the protagonist's behavior (i.e., reported whether they liked or disliked their choices) and (2) had the opportunity to intervene (i.e., by directly confronting the protagonist, reporting the behavior to a teacher, or including the excluded peers themselves). By examining children's encoding, evaluations, and behaviors, this study sheds light on how children recognize and respond to racial bias.

**REICHARD,
Rachel**

Major: Art History

Certificate:
Theatre and Drama

Exploring Space and Body in Auguste Rodin's Assemblages through Devised Movement Theatre

Advisor: Nancy Rose Marshall

Thesis department: Art History

Throughout his artistic career, Auguste Rodin explored the expansions and limitations of the body in representation through the creation of his assemblages: sculptures composed of existing objects within his collection, either situated with each other or standalone pieces. These assemblages make up a good chunk of his canon, but are often overlooked in the academic study of his work. These works captured a specific emotional feeling that extended beyond the confines of the work; this quality was observed during Rodin's time and continues to inspire today. This project used four pieces by Rodin all under the umbrella of assemblage; Assemblage of the Heads of the Burghers of Calais (c. 1900), The Hand of the Devil Holding Woman (c. 1903), the Hand of God (c. 1895), Abattis (N.D), and Hand of Rodin with a Female Figure (c. 1917). The application of these works in this project demonstrate the physical impact of Rodin's work by exploring the intersectionality of art historical methodology and theatre-based practices through the conception of a devised theatre piece.

**SAEMANN,
Geoffrey**

Heterobifunctional LYTACs degrade α -synuclein fibrils in hepatocyte cell culture

Major: Biochemistry

Advisor: Aaron Hoskins

Certificate:
German

Thesis department: Biochemistry

Amyloidoses are a class of diseases characterized by prion accumulation and formation of aggregates. Amyloid-associated diseases include Alzheimer's and Parkinson's diseases and are some of the leading causes of hospitalization, admission into long-term care facilities, and death among senior citizens in the United States. A critical physiological change in the progression of these diseases is formation of aggregates which leads to progressive neurodegeneration. One such aggregate-forming protein is α -synuclein, and α -synuclein fibrils have been associated with progression of both Parkinson's and Lewy body dementia. Lysosome-targeting chimeras (LYTACs) are heterobifunctional molecules that localize target proteins to extracellular receptors and cause intracellular degradation via the lysosomal pathway. LYTACs are a method of target protein degradation which utilize antibodies or small molecules to localize target proteins to extracellular receptors and degrade them intracellularly via the lysosomal pathway. The asialoglycoprotein receptor (ASGPR) is an endocytic cell surface receptor in hepatocytes which is used to mediate glycoprotein levels in the blood. Here, we are developing an α -synuclein-targeting LYTAC by glycosylating an anti- α -synuclein antibody with tri-antennary N-acetylgalactosamine (tri-GalNAc) using click chemistry. We will then test if this LYTAC can cause degradation of α -synuclein fibrils introduced into a hepatocyte cell culture via the ASGPR receptor pathway using a fluorophore-based microplate assay. We will also assess potential cytotoxicity of the treatment using a microscope-based cell viability assay.

**SCHENSE,
Nicholas**

Application of Uncertainty Quantification to an Alzheimer's Diagnosis Neural Network for Improved Clinical Translation

Majors:
Mathematics,
Physics

Advisors: Robert Jeraj and Alison Deatsch

Certificate:
German

Thesis department: Physics

Many sources of uncertainty exist in the use of neural networks for the diagnosis of Alzheimer's disease (AD). Accurate and reliable quantification of uncertainty is important for their clinical implementation. This project aims to improve the clinical relevance and translation of AD diagnostic models through the addition of uncertainty. We used a previously developed CNN trained as a binary classifier of AD and normal controls from FDG PET neuroimaging data. We tested several existing methods of uncertainty quantification, including Model Ensembling and Bayesian Networks, since no one method has been shown to be the single best or able to capture all relevant types of uncertainty. We directly compared each metric with external measures of uncertainty consisting of physician confidence, longitudinal diagnosis change, and increasing image noise, to allow for improved interpretation of their physical meaning. Preliminary results show that Model Ensembling captures ground truth uncertainty corresponding to physician confidence and image noise and significantly increases overall model performance, though analysis of Bayesian Models and longitudinal

results is thus far inconclusive. The evaluation of uncertainty quantification for models such as this allows for greater understanding of the outputs of these models, increasing their applicability in a clinical setting.

**SHERMAN,
Hannah**

Major:
Communication
Sciences and
Disorders

Structured Perceptual Evaluation of Children's Speech by Undergraduate Students

Advisor: Katie Hustad

Thesis department: Communication Sciences and Disorders

For the student version of the SPECS (Structured Perceptual Evaluation of Children's Speech) study, sixteen Communication Sciences and Disorders undergraduate students listened to speech samples taken from typically developing children and rated their perceptual speech features. Half of the students received training on how to rate each speech feature accurately, and the other half of the students received no training. In comparing the training and no training conditions, there was no significant difference. There was a slight descriptive trend that may be an indication that professional training is necessary in order to be an effective speech-language pathologist. The child speech samples came from 4 different children, two four-year-olds and two eight-year-olds; there was also one female and one male per age group. When comparing the children of different ages, we found that many of their speech features, such as intelligibility and articulation, were rated as more adult-like in the older children than in the younger children. We know that improvement of these speech features is a part of typical speech development in children. This result may indicate that the SPECS system has the ability to capture neurotypical development trends, even when the raters are naïve or trained undergraduate students.

SIDHU, Mannet

Major: Molecular
and Cell Biology

Certificate: Biocore

Investigating the Impact of Methionine Restriction and SLC7A11 Inhibitors on Triple-Negative Breast Cancer

Advisors: Vincent Cryns, Elena Strekalova, and Muhammad Salah

Thesis department: Molecular and Cell Biology

Triple-Negative Breast Cancer Cells (TNBCCs) lack hormone receptors and rely on additional metabolic pathways for survival. Methionine (Met) fuels tumor growth through methylation and redox balance. Methionine Restriction (MR) can affect cellular metabolism and stress responses. Ferroptosis is an iron-dependent cell death driven by lipid peroxidation and regulated by cystine uptake using SLC7A11, a transmembrane cystine/glutamate antiporter. The knowledge of MR impact on ferroptosis sensitivity in TNBCCs remains limited. It was hypothesized MR-induced SLC7A11 expression will increase TNBCC sensitivity to inhibition.

SITRIN, Erin

Major: History

Certificate:
Integrated Liberal
Studies***The Katte Affair: Family, Sexuality, and the Subjugation of Frederick the Great*****Advisor:** Eric Carlsson**Thesis department:** History

The 1730 Katte Affair was the 18-year-old Frederick the Great's failed flight from his abusive father and life at the Prussian court. This event resulted in the execution of Frederick's intimate friend, Lieutenant Hans Hermann von Katte, which Frederick himself was forced to witness. It marked a pivotal moment in the life of this eighteenth-century monarch. However, the affair has received relatively limited attention in modern scholarship. Thus, this thesis argues that the event shaped Frederick's political identity, reflecting a struggle between paternal authority and personal defiance under Frederick William I of Prussia. This presentation focuses on one section: the investigation into the legal elements of Katte's sentencing. Research indicates that Katte's punishment did not align with the crimes he was accused of; rather, his execution more closely paralleled practices used to punish same-sex relationships in eighteenth-century Prussia. This suggests that Katte's execution likely served as a way for Frederick's father to punish his son's sexuality, reinforcing that such relationships would not be tolerated.

SUNEJA, MyaMajors:
Neurobiology,
PsychologyCertificate:
Social Justice and
Education***The Role of Social Support in the Relationship Between Higher Education in Prison and Depressive Symptomatology*****Advisors:** Mike Koenigs and Mickela Heilicher**Thesis department:** Psychology

Depression is prevalent in incarcerated populations in the United States. A parent study by researchers at the University of Wisconsin found a significant inverse relationship between higher education in prison (HEP) and depressive symptomatology (Nguyen et al., in press). Social support from friends and family is recognized as a powerful protective factor against depression; however, the role of social support in the relationship between HEP and depressive symptomatology is unknown. This study aimed to quantitatively investigate whether social support significantly moderates the relationship between HEP and depressive symptomatology using self-report measures of depression (e.g., Beck's Depression Inventory II) and social support (number of in-person and phone/video visits from friends and family) during incarceration. Participants were 42 incarcerated men in three Wisconsin state prison facilities. Results showed insignificant interactions between social support and the relationship between HEP and depression. Results of this study introduce important limitations and propose future directions for research relating to HEP, depression during incarceration, and social support in prison.

TARANTINO, NickMajors:
Communication
Arts, Psychology***Canonical Associations Between Numerosity and Linear Trends in Arrays*****Advisor:** Martha Alibali**Thesis department:** Psychology

Graphs can rapidly convey complex quantitative information by depicting it using basic non-symbolic magnitudes such as lengths and colors. Graphs are readily

interpretable even without formal training, yet also support complex mathematical reasoning. This study tested whether simple graphical judgments recruit abstract quantitative representations by examining whether the number of elements in an array affects the perception of the trend it depicts. In an online setting, participants compared dot arrays that varied in numerosity (12–22 points) and the regression slope of their coordinates to a neutral reference array (15 points, zero slope). Participants used the keyboard to perform one of two tasks: judging whether the novel stimulus had more or fewer points (numerosity task) or whether it showed an increasing or decreasing trend (trend task), both relative to the neutral array. As predicted, we found that participants showed slowed responses to numerous arrays (>15 dots) with decreasing slopes and to sparse arrays (<15 dots) with increasing slopes in the trend task, but not in the numerosity task. These findings suggest that increasing and decreasing relations are associated with different numerical magnitudes, and that very simple graphical tasks, like the present one, elicit these abstract associations.

**VARDANYAN,
Andre**

Majors: Economics,
Mathematics,
Political Science

Certificates:
Physics, Statistics

The Effect of Policy Incentives on Electric Vehicle Adoption in the European Union

Advisor: Menzie David Chinn

Thesis department: Economics

The European Union has implemented a variety of policy incentives to promote the adoption of electric vehicles (EVs). These include VAT deductions, registration tax exemptions or reduced rates, ownership tax exemptions or reduced rates, and direct purchase incentives such as subsidies or price discounts. This thesis analyzes the effect of each of these policy tools on EV adoption and explores which policies are most effective in increasing the share of new EVs, with broader implications for countries seeking to accelerate EV uptake worldwide.

**VISWANATHAN,
Lalitha**

Majors: Journalism,
Political Science

Certificate: Digital
Media Analytics

Brahmin Press, Dravidian Power: The Hindu's coverage of the 1967 Madras State Legislative Assembly Election

Advisor: Kathryn McGarr

Thesis department: Journalism

This thesis analyzes the coverage of the 1967 Madras Legislative Assembly election in *The Hindu*, a prominent English-language daily newspaper owned by the Brahmin elite. During the 1920s, the Madras Presidency saw the rise of the Dravidian movement, which sought to dismantle the political and social dominance of a Brahmin movement that comprised only three percent of the population. The 1967 election marked a revolution, as the anti-Brahmin Dravida Munnetra Kazhagam secured a majority, ousting the Indian National Congress, which had been the ruling party since Independence. By analyzing Monday "Weekly Review" editions from January to March 1967 in *The Hindu*, this research explores how Brahmin ownership and an elite caste, English-educated readership influenced the portrayal of an election that fulfilled anti-Brahmin political interests. Ultimately, this thesis finds that *The Hindu* aimed to delegitimize the DMK party and victory before, during and after the election by weaponizing a 'stability narrative' and characterizing DMK voters as the 'illiterate

masses.' Over time, there was a shift in editorial tone to become more positive toward the DMK, and this stabilized once the new DMK government promised to protect the structural and linguistic status of the Madras elite.

WHALEYSMITH, Sincere

Major: Sociology

Certificates:
African American
Studies,
Educational Policy
Studies,
Food Systems,
Global Health

Grocery Stores and Food Insecurity

Advisor: Kathryn McGarr

Thesis department: Sociology

In the past two decades, scholarship has shifted the conceptualization and measurement of food insecurity. Once characterized by "food deserts", recent studies have transitioned towards a focus on which systemic factors perpetuate unjust food systems. Unlike much of academia, many Black feminist thought producers and community activists have been major proponents of this approach for years. Still, there is a lack of quantitative studies that investigate how grocery store infrastructure affects food security differentially across racial groups. In this study, I build on the framework of longstanding Black feminist food theory and praxis, using Census data on household food insecurity and grocery store counts in metropolitan areas to identify how grocery store counts are associated with residents' likelihood of food insecurity.

WHITNEY, Cleo

Major: Journalism

Certificates:
Education and
Educational
Services,
Educational Policy
Studies,
Global Health

Adolescents' Representations of Physical Activity on Social Media: Solo or Social?

Advisors: Christopher N. Cascio and Soyeong Cho

Thesis department: Journalism

Social media is part of everyday adolescent life, raising concerns about its influence on behavior. Previous research has largely focused on time spent on social media in relationship to behavior, however, there remains room to further explore how adolescents frame physical activity in their social media posts, particularly across different social contexts. In order to address this question, the current study aims to examine displays of physical activity on social media as a form of self-presentation. Specifically, we examined representations of solo forms of physical activity versus socially oriented forms of physical activity. These representations may shape how physical activity is perceived and valued among adolescents and their peers. Understanding how these depictions frame physical activity may provide insight into adolescents' self-identity and self-presentation.

WOLFE, Henry

Majors: Chemistry,
Environmental
Studies

Quantifying pH Dependence of Nucleotide Extinction Coefficients: Considerations for UV Transmission in Prebiotic Waters

Advisor: Zoe Todd

Thesis department: Chemistry

The Early Earth had an abundance of UV light compared to the Modern Earth. This UV light could have been used to drive chemical reactions important for the development of life, but it also could have led to the degradation of important prebiotic molecules. This study was done to understand how the five nucleotides

used in modern RNA and DNA could act as shields to absorb UV light, with a consideration of how the pH environment affects this absorption. The results show that the five nucleotides can effectively reduce the penetration depth of UV light, and that the pH environment affects the absorption spectra in different ways. Further work could be done to understand the shielding properties of other biomolecules, like amino acids.

**WOLLMUTH,
Catherine**

Majors: Chemistry,
Global Health

Asymmetric Axial Ligand Substitution of HEMACs

Advisor: John Berry

Thesis department: Chemistry

Heterometallic extended metal atom chains (HEMACs) are an important class of compounds for studying metal-metal bonding and for their potential applications in molecular electronics. In particular, Mo_2M (M = transition metal) complexes are a useful platform to explore how changes in the coordination environment influences electronic structure and reactivity. While previous studies have focused on symmetric axial ligand substitution, little work has been done on asymmetric substitution. This work explores stepwise axial ligand substitution in $\text{Mo}_2\text{Ni}(\text{dedpa})_4\text{Cl}_2$ complexes. The initial substitution of one chloride ligand was done with thiocyanate (SCN^-). This was followed by the introduction of a second ligand, either selenocyanate (SeCN^-) or benzoate ($\text{C}_7\text{H}_5\text{O}_2^-$). The products were characterized using a variety of analytical techniques, including MALDI mass spectrometry and NMR spectroscopy. Results demonstrate that both the first and second axial ligand substitution can be achieved, providing evidence for the formation of asymmetrically substituted complexes. However, characterization and isolation of pure products proved challenging due to dynamic equilibria in solution and similar solubilities of reactants and products. Overall, this work demonstrates the viability of asymmetric axial ligand substitution, but highlights challenges in purification that must be addressed in future studies.

YANG, Yuwen

Majors:
Mathematics,
Theatre and Drama

Imagining a new Chineseness: Chinese International Students' Theatre in the U.S. from 1906-1931

Advisor: Baron Kelly

Thesis department: Theatre and Drama

This paper brings forth research on the Chinese international students theatre (CIST) in the U.S. between 1906 and 1931. This deeply understudied field, often dismissed because of its amateur status and sparse archival records, offers valuable insights into how performance enabled Chinese students to negotiate their foreign identity under the precarities, misrepresentations, and nostalgia. This study reconstructs CIST performance histories by assembling archival evidence from *The Chinese Students' Monthly*—a central periodical that extensively documented Chinese student activities—alongside newspaper coverage, memoirs, and surviving manuscripts. Drawing on Christopher Balme's theory of intercultural theatre and Edward Said's concept of Orientalism, I analyze how CIST reshaped spectatorship through its textual and theatrical strategies, and how these strategies produced an anti-Orientalist discourse. I would argue, CIST performances, as a form of amateur intercultural theatre, becomes a site where knowledge is translated and produced,

and where visibility, representation, and community formation are negotiated across linguistic and cultural boundaries in the early twentieth century. In this process, CIST generated new forms of “Chineseness” that shaped not only American spectators’ understanding of China, but also Chinese students’ understanding of themselves. More specifically, I examine how staged Orientalism could be altered through the continual production of new forms of Chineseness, and how these emerging forms of Chineseness became an important anchor for Chinese students themselves, helping to constitute them as an imagined community.

YOSEF, Sarah

Majors: African
Cultural Studies,
History, Legal
Studies

Certificates:
Classical Studies,
Criminal Justice

From the Classroom to Confinement: How Juvenile Detention Replicates School-based Exclusion?

Advisor: Ion Meyn

Thesis department: Legal Studies

This paper investigates structural parallels between public school classrooms and juvenile detention centers. Situated within the general scholarship, this paper presents findings from a local case study informed by observations at the Dane County Juvenile Detention Center and interviews with stakeholders at the Detention Center and the Madison Metropolitan School District (MMSD). The paper demonstrates how, in important respects, the public-school environment mirrors educational settings within carceral environments. In both settings, education is frequently subordinated to security concerns or treated as a disruption to institutional order. Disciplinary practices do not merely interrupt learning but actively generate educational deprivation, reinforcing a cycle in which marginalized youth are denied meaningful opportunities for academic development. The paper shows that many local reforms—such as MMSD’s removal of School Resource Officers—fail to address deeper systemic issues of race and disability that anchor these conditions.