



Honors Program
COLLEGE OF LETTERS & SCIENCE
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2024 Honors Senior Thesis Symposium Abstracts

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**ARRENDONDO,
Alivia**

Major(s):
Environmental
Science and
Conservation
Biology

Certificate(s):
Indigenous Studies

Whitebark Pine: a potential key species in the food web of American Martens

Advisor(s): Jonathan Pauli

Thesis department(s): Conservation Biology

Whitebark pine (*Pinus albicaulis*) is a key resource in alpine ecosystems of western North America. American martens (*Martes americana*), a small-bodied carnivore of conservation concern, consume a variety of foods, but the importance of Whitebark pine is unknown. We analyzed stable isotopes ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) from 79 martens and their prey and found that Whitebark pine nuts constituted >40% of marten diets. The rest of their diet was comprised of small mammals (15-54%) and tree squirrels (3-7%). The correlation between marten use of different diet groups was relatively low (0.05) between pine and squirrels, but higher between pine and small mammals (0.49). Our results reveal a surprising reliance of marten on Whitebark pine and its central role in alpine food webs.

BINK, Julia

Major(s):
Neurobiology and
Psychology

Certificate(s):
Biology Core
Curriculum

Body mass index moderates the relationship between the apnea-hypopnea index and CSF biomarkers of activated microglia

Advisor(s): Diane Gooding and Barbara Bendlin

Thesis department(s): Neurobiology and Psychology (Dual Honors Thesis)

Several studies suggest obstructive sleep apnea (OSA) is associated with Alzheimer's Disease (AD) biomarkers and related pathology, but it is unclear how early these relationships present. The present study aimed to investigate the relationship between the apnea-hypopnea index (AHI) and cerebral spinal fluid (CSF) biomarkers of AD and related pathology. A cross-sectional study of 73 cognitively normal adults with no prior OSA diagnosis underwent an overnight polysomnography (PSG) and/or testing with at home ApneaLink. Participants completed a lumbar puncture to determine β -amyloid 42/40, pTau, NfL, GFAP, s100, YKL-40, and sTREM2 as part of the Roche NeuroToolKit research platform (Roche International). Relationships between AHI and CSF were determined using multiple linear regression adjusting for age, sex, APOE genotype, and with or without BMI. We also tested interactions between AHI and APOE as well as AHI and BMI. There was no significant association between AHI and CSF levels ($p > 0.05$) even when controlling for BMI ($p > 0.05$). When testing an interaction with BMI, we found when BMI increased the association between AHI and sTREM2 was decreased ($p = 0.02$); however, this relationship diminishes at a higher BMI level. Additionally, there was no significant interaction between APOE and AHI ($p > 0.05$).

**BRAINANOVA,
Vicki*****Using the Continuous Voxel Intensity Distribution to analyze simulations of line intensity mapping with the [CII] line***

Major(s):
Astronomy-Physics

Advisor(s): Peter Timbie

Thesis department(s): Physics

Certificate(s):
Computer Sciences

The Experiment for Cryogenic Large-Aperture Intensity Mapping (EXCLAIM) is a balloon-borne cryogenic telescope that will survey diffuse emission from the Milky Way and cosmic web to probe star formation, the interstellar medium, and galaxy evolution across cosmic time. The telescope primarily observes bright spectral lines emitted by singly-ionized carbon [CII] and carbon monoxide (CO) from the present up to redshift $z = 3.5$. Because the telescope collects line intensity maps over these redshifts, the data is stored in 3D pixels, termed voxels. Using the formalism of the conditional voxel intensity distribution (CVID) and the number density of BOSS Quasars in each voxel, we simulate the ability of EXCLAIM to detect the signal emitted by the [CII] line from redshift $2.5 < z < 3.5$ for a variety of models for the CII luminosity function.

CANDLER, Noelle***"Hold me, water": Exploring Care Collectives and Colonial Realities in Cantoras by Caro De Robertis***

Major(s):
Gender & Women's
Studies and English

Advisor(s): Jess Waggoner

Thesis department(s): Gender & Women's Studies

Certificate(s):
Biology Core
Curriculum

Traditional discussions of political resistance raise images of masculinized forms in the cultural imagination, while feminized efforts are obscured or overlooked. In their novel *Cantoras*, Caro De Robertis crafts the tenacious world of five queer women who find refuge from the violently enforced silence of Uruguay's civic-military dictatorship through acts of feminine care and community building. How can femme care collectives heal the pain imposed by neoliberal ideologies and authoritarian oppression? The novel's radically communal femininity coexists with Uruguay's material reality as a nation founded on colonial invasion. As these women resist through care, they too are implicated in a long history of violence against and erasure of indigenous lives and cultures. Addressing this tension between healing and harm recognizes the significance in continuing to understand that liberation for any must be liberation for all.

CHUNG, Paul

Major(s):
Computer Sciences
and Data Science

Shawshank Prison: Identifying Network Censorship Patterns and Approaches Used by ISPs around the World

Advisor(s): Rahul Chatterjee

Thesis department(s): Computer Sciences

Governments around the world regularly restrict their citizens from accessing certain websites by employing various network censorship technologies. In order to document the current state of network censorship in different countries, researchers have been conducting experiments focusing on what web resources are being censored, and how to evade such censorship. Censors over the years have built a complex suit of tactics to enact. However, no prior work has given a thorough investigation into how censorship is enacted by censors around the world, and how robust they are.

Therefore, we present the trend of robustness among the censorship system implementations and identify previously unknown state-of-the-art censorship technologies. Using a series of heuristics, we conduct (1) censorable content exposure and (2) censorship circumvention experiments in 50 different countries. From the results, we identify the trend of preferred censorship technologies and highlight unique state-of-the-art censorship mechanisms found. Based on the findings, we provide protocol-level recommendations that could fundamentally mitigate current issues that allow for extensive internet censorship. We hope that the results of the study could give specific insight into how censorship systems could be structured and would be helpful in increasing the internet freedom of people in heavily censored countries.

COLLINS, Abigail

Major(s):
Psychology

Certificate(s):
Entrepreneurship

"As a Father of Two Daughters...": The Influence of Having Daughters on Policy Makers' Real and Perceived Gender Egalitarianism

Advisor(s): Stav Atir

Thesis department(s): Psychology

Men in political leadership positions dictate policies that affect women's lives. When speaking about women-related policies, men sometimes invoke their relationships with women to self-credential, e.g., "As a father of daughters...". Is this effective, and should it be? We answer these questions in three pre-registered studies. In the first study, participants read a speech from a (fictitious) male U.S. senator speaking on women's right to healthcare where the policy maker either invoked being a father of daughters or did not. If the policy maker invoked his daughters, participants thought he was better credentialed to speak on the issue. In an additional experiment, participants reported believing a father of daughters to be less sexist compared to the average man and a father of sons. Yet, a follow-up, well-powered study found that fathers of daughters were just as sexist as fathers of sons, and held similar views on women-related issues. Thus, this common belief mistakenly asserts that fathers of daughters hold more gender egalitarian views. Consequently, invoking relationships with women may be an effective but misleading tactic for self-credentialing.

DEBARGUE, Elsa ***The Unearthed of Gender Dynamics: The Leading Women of La Movida Madrileña***

Major(s):
Spanish and

International Studies

Advisor(s): Juan Egea, Sara Mckinnon

Thesis department(s): Spanish and International Studies

Certificate(s):
Gender & Women's
Studies, Russian and
Eastern European
Civilizations, and
European Studies

The paper examines the role of women in La Movida Madrileña, a countercultural movement following the death of Spanish dictator Francisco Franco. While existing studies often focus on economic impacts of the movement and the LGBTQ+ community, this thesis highlights the overlooked Feminist efforts during this period. By analyzing various Feminist figures and magazines like Ajoblanco and La Vindicación Feminista, the research aims to assess whether La Movida was beneficial for Feminism or other communities.

Two prominent figures, Ouka Leele and Mariví Ibarrola, are central to the analysis. Ouka Leele's vibrant photography challenged traditional gender roles, depicting women as creators of color and agents of change. Mariví Ibarrola, though less known, used photography to capture the liberation of the era, particularly in the nightlife scene. Both artists embodied the "New Woman" archetype, defying passive roles and embracing freedom. Through primary and secondary sources, the study aims to avoid bias and provide a nuanced view of Feminist contributions to La Movida. Additionally, it explores the impact of these women on contemporary Feminism in Spain. By shedding light on their artistry and defiance against Francoist repression, this research seeks to rectify the historical oversight of women's pivotal role in this time period.

FLYNN, Keeley

The Avatar in New Media: Glitches, Cyborgs, and Feminist Framework For Earthly Survival

Major(s):
Art and Art History

Advisor(s): Anna Campbell

Thesis department(s): Art History

Avatars operate as digital extensions of our real-world identities, enabling us to navigate the internet without the limitations of our physical bodies. The avatar within a virtual world functions as a tool to reimagine our digital future and tell the stories of marginalized groups without the threat of an "irl" binary. New media artists reclaim power that our physical world has failed to provide through avatar creation. Digital realms give space for artists of color as well queer and trans artists to express their identities. In my thesis, I use artists Cao Fei, Puppies Puppies (Jade Kuriki-Olivo), and Ava Wanbli as case studies to explore the avatar. Donna Haraway's "A Cyborg Manifesto" and Legacy Russell's "Glitch Feminism" provide a framework for the concept of the avatar; additionally, these texts inform my case studies' artistic choices.

FOOR, Chloe***Enchanted Landscapes: Transforming Spaces through Witchcraft and Sorcery in 17th-century Cartagena***

Major(s):
History, Computer
Sciences, and
Information Science

Advisor(s): Marcella Hayes

Thesis department(s): History

Between 1610 and 1660, the Cartagena Inquisition prosecuted over fifty women for the crimes of witchcraft and sorcery, the vast majority of whom were women of African descent. Through a close examination of the trial records of these alleged witches and sorcerers, we can recognize how they utilized the heretical practices of magic to transform their surroundings into places of resistance against the colonial Spanish authorities. These transformations took place in the hinterlands of the city, mostly through witch gatherings called juntas, in the city itself, transformed through spells and demonic rituals, and even in the Inquisitorial Palace, through the crafting of narratives during trials.

GAO, Haozhan***Overeducation in Social Learning***

Major(s):
Math and Economics

Advisor(s): Matthew Wiswall

Thesis department(s): Economics

I study the overeducation problem in a signaling game under a dynamic setting in which workers with continuous abilities choose from discrete education levels. In the static case as a building block, I introduce fuzzy information where workers cannot observe their abilities perfectly and prove that the fuzziness may encourage workers to take risks by choosing a higher education level, resulting in overeducation issue. In the dynamic case where myopic workers make decisions based only on realized wages from the last period, I discuss two scenarios: If information is free and workers move non-strategically, I prove that under a technology shock where the return on education is suddenly increased, society will converge to the destination equilibrium only if the return is moderate; If information is costly and they make strategic decisions about learning, I prove that only a fraction of workers will have the incentive to learn from the shock, and the learning process will become slower each period as the society approaches the destination equilibrium.

GESNER, Sarah***Imagen That: TikTok, Film, and the Evolution of Women's Body and Beauty Norms in Spain***Major(s):
Sociology and
Spanish**Advisor(s):** Frankie Frank, Juan Egea**Thesis department(s):** Sociology and SpanishCertificate(s):
Gender & Women's
Studies

This thesis conceptualizes how social media, film, and health define and influence body image and beauty norms in Spain. Specifically, my research pertains to how Spanish film addresses body image, the role of social media – specifically TikTok – in the diffusion of body image ideals among Spanish women users, and the influence of mother-daughter relationships on young women's body image and self esteem. The literature suggests food and health trends in Spain historically target women. After the death of Nationalist dictator Francisco Franco in 1975, however, popular culture and media sources help Spanish women transition an era of obedience to one of confidence and dimension. Popular culture and media sources play a large role in this transition, especially with regard to the portrayal of women's bodies. The decision to incorporate films and TikToks in this study is crucial in highlighting the multifaceted, both historically and contemporarily relevant nature of women's body image in Spain. My research is based in grounded theory, a qualitative approach that allows for concurrent data collection and analysis and incorporates sociological coding to extract key themes. Among the 36 categorical codes analyzed, "Body Positive Movement Opinions" and "Normative Womanhood" were the most prevalent. TikTok and mother-daughter relationships were also found to have profound effects on young women's body image and conceptions of beauty. This research highlights the value and import of ongoing discourse about women's body image in Spain as societal standards and influences continue to shift.

GITZLAFF, Lauren***Relationships between brain microstructure and Braak Stage progression in Alzheimer's disease (AD)***Major(s):
Neurobiology and
Psychology**Advisor(s):** Barbara Bendlin, Jason Moody**Thesis department(s):** NeurobiologyCertificate(s):
Health and the
Humanities

Tau protein hyperphosphorylation leads to neurofibrillary tangle (NFT) accumulation, a neuropathological hallmark of AD. While traditionally assessed postmortem with Braak staging, tau pathology can also be detected with PET imaging. Braak stages represent AD progression, tracking NFT presence in brain regions like the entorhinal cortex (Stages I-II), limbic areas (III-IV), and neocortex (V-VI). Diffusion weighted imaging (DWI) shows promise in revealing AD-related microstructural changes by detecting NFT formation. This study examines relationships between DWI metrics and Braak stage progression.

Wisconsin ADRC and WRAP participants on the AD continuum underwent multi-shell DWI and MK-6240 PET imaging within 36 months. Neurite Density Index (NDI), Orientation Dispersion Index (ODI) and Isotropic Volume Fraction (ISO) parameter maps were computed. Adjusting for covariates, a linear mixed-effects model will analyze potential relationships between DWI metrics and Braak stage progression in the parahippocampal gyrus, hippocampus, and whole-brain cortical gray matter. We anticipate lower NDI and ODI values, but higher ISO values with increasing Braak stages, reflecting gray matter changes and neurodegeneration. Our results provide insight into pathological patterns of AD-related neurodegeneration, as indexed by DWI metrics, and may speak to DWI's potential use in early detection of NFT formation.

GLASPER, Aliya***Aesthetics of Care: the FWD: Truth Campaign & Community-Based Repair***Major(s):
Art History**Advisor(s):** Jill Casid**Thesis department(s):** Art HistoryCertificate(s):
French and Gender &
Women's Studies

Issues of structural racism and misogyny constitute the growing call for different art domains, especially museum institutions, to self-examine and to reject the myth of neutrality. The FWD: Truth Campaign is the first campaign to explicitly call out misogynoir in museums. Coined by Black scholar Moya Bailey, misogynoir describes the uniquely corrosive mode of oppression faced by Black femmes. The campaign focuses on the Madison Museum of Contemporary Art (MMoCA) in Madison, Wisconsin and the allegations of structural misogynoir that emerged during the 2022 Wisconsin Triennial: Ain't I a Woman? This was the first exhibition at the museum to highlight Black women and femme-identified artists and their work. This thesis situates the Black women artist-led campaign within the global context of cultural reckonings that have charged the museum institution with the perpetuation of white supremacy and inequality. Through in-depth analysis of its campaign strategies, this research demonstrates that FWD: Truth ultimately promotes joy, empathy, and decolonial sentiments by fashioning space for deep healing and relationality amidst calls for institutional accountability. FWD: Truth and its commitment to aesthetics of care sets an example for what museum institutions ought to embody. In discussing this instance of contemporary protest through the critical lens of misogynoir, I aim to highlight and suggest a more nuanced path forward in which alternative techniques can constitute a new art world.

GOYAL, Agam***Interpretable Extraction of Latent Spatiotemporal Emergent Properties of Complex Network Dynamics***Major(s):
Computer Sciences,
Data Science, and
Mathematics**Advisor(s):** Hanbaek Lyu**Thesis department(s):** Computer SciencesCertificate(s):
Economic Analytics

Groups of locally interacting agents can lead to complex large-scale emergent behaviors on underlying networks, and predicting the eventual state of such systems can often be analytically intractable due to their highly non-linear nature. While recent studies have tried to tackle this issue with the use of machine learning models, there remains the need for an end-to-end interpretable framework for this problem. We propose to develop a supervised feature extraction method of supervised CP tensor decomposition (SupNCPD) to extract key spatiotemporal patterns of emergence at the subgraph level and utilize these features to predict the emergent behavior of the system in an interpretable manner, by making use of a nonnegativity constraint in our framework. We also propose to undertake a theoretical analysis of our proposed algorithm to provide convergence guarantees and iteration complexity. We believe that having an interpretable framework for analyzing these complex systems which also has predictive power compared to the theoretical baselines would prove to be crucial to the advancement of our understanding of these systems and allow for wide adoption of machine learning-based techniques for more important applications.

GRIFFIN, Amory***Silver Catalyzed C–H Amination as a Route to Novel Mycobacterium tuberculosis Inhibitors***

Major(s):
Chemistry and
Biochemistry

Advisor(s): Jennifer Schomaker

Thesis department(s): Chemistry

Mycobacterium tuberculosis (Mtb), the causative agent of tuberculosis (TB), is one of the leading causes of mortality in developing countries. In collaboration with Eli Lilly Open Innovation Program and GSK, the Schomaker lab has identified a novel class of Mtb inhibitors utilizing the Schomaker lab's nitrene transfer chemistry. These novel N-heterocycles show potential for a new mechanism of action to target drug resistant Mtb. In order to understand the properties of these inhibitors, a generalized synthetic route was employed to synthesize a series of novel N-heterocyclic sulfamates. Prior to synthesis, computational models were employed to guide the selection of target compounds. In collaboration with the Rohde lab (University of Central Florida), a broad range of these compounds were tested for their activity in vivo to guide further optimizations. Through this collaboration, the Schomaker lab hopes to illuminate the potential of these novel N-heterocycles in addressing the growing concern of drug-resistant Mtb.

HOTTMAN, Cade***Identifying cortical areas by their gene expression profiles***

Major(s):
Neurobiology and
Molecular & Cell
Biology

Advisor(s): Andre Sousa, Anita Bhattacharyya

Thesis department(s): Neurobiology & Molecular & Cell Biology

Certificate(s):
Global Health and
Biology Core
Curriculum

Neuropsychiatric and neurodevelopmental disorders continue to be a leading cause of morbidity worldwide, making it essential to better characterize their modes of action. However, the molecular and cellular mechanisms governing such disorders remain widely disputed. To answer these questions, researchers have begun to transition from animal models to the use of human samples. This effort has been slowed as archived frozen human brain samples often lack structural integrity or have lost anatomical landmarks. To better utilize this tissue, the expression of several known cortical area markers were investigated across early and mid-fetal development. Through absolute quantification via droplet digital polymerase chain reaction, a novel method for identifying cortical areas through a gene expression matrix of the selected marker genes was compiled across early mid fetal development. Specifically, the markers CLMP, NR2F2, and WNT7B allowed for the delineation of anterior versus posterior regions and vice versa in the human cortex. This methodology can continue to be expanded to additional marker genes to generate a reference map of the human brain to better utilize limited frozen samples. The additional research with such samples lacking anatomical landmarks widens the array of molecular techniques available to researchers and thus could have several biomedical implications within the fields of neuroscience and cellular biology.

JARVIS, William***An Analysis of Radio AGN Plasma Ages Calibrated Using Magneto-Hydrodynamic Jet Simulations and Their Application to Real Galaxies***Major(s):
Astronomy and
Physics**Advisor(s):** Marsha Wolf, Eric Hooper**Thesis department(s):** Astronomy

Radio AGN (RAGN) commonly include radio jets that may distribute energy throughout their host galaxy, potentially contributing to quenching of the galaxy's star formation. We present a technique used to date the ages of plasma in the jets based on the spectral energy distribution of the synchrotron emission. We assume the spectral aging method, where high energy particles which leave the jet fill the lobes and slowly lose energy via synchrotron radiation and inverse-compton mechanisms over time. To calibrate this technique, we compare numerical simulations of AGN with both active and inactive jets with a sample of RAGN - observed using the uGMRT and from surveys including NVSS, TGSS, and WENSS - in various phases of AGN activity to test the efficacy of our approach. We simulate a range of jet powers and environmental conditions, ranging from isolated galaxies to dense clusters, that match the envelope of our observational sample. The calibrations derived from the simulations will lead to a better understanding of the systematic uncertainties in our age results to correct the observation-derived ages. We conclude by showing an analysis of the simulations and a test case for the application of our method on a real galaxy.

JENKS, Ashton***Morphological Sexual Dimorphism with an eye to Homo naledi***Major(s):
History,
Anthropology, and
Classical Humanities**Advisor(s):** John Hawks**Thesis department(s):** AnthropologyCertificate(s):
Archeology, Gender
and Women's
Studies, and
European Studies

Estimating the skeletal sex of extinct hominins is challenging, both because of the fragmentary nature of the fossil record and because the correlation of skeletal traits with sex may be different in different species. Recent work on dental size variation has suggested that the *Homo naledi* sample from the Rising Star cave system, South Africa, may exhibit a bias overrepresenting one sex. We chose to investigate whether any bias can be demonstrated with cranial morphology. We assessed approaches based on metric and categorical traits previously found to correlate with sex in human population, as well as a few new ones, and examined their variation in skeletal samples of known sex of recent humans, from the Maxwell Osteology collection at the University of New Mexico. Expanding from the typical five feature method into a method based on metric traits led to highly accurate sex estimation in the recent human sample. However this multivariate method requires well-preserved crania. Categorical traits were much less accurate on the same sample, suggesting a limited value for assessing skeletal sex in fossil crania, but could still have some applications. Applying this comparative sample to evaluate variation in *Homo naledi*, we found that the cranial data do not reject the hypothesis of biased representation as suggested by dental variation, at least within this limited model.

**KIRKPATRICK,
Cayden**

Managing the "Long Knives": Ho-Chunk International Policy Between the War of 1812 and the Black Hawk War

Major(s):
Astronomy-Physics,
History, and French.

Advisor(s): Professor John Hall, Professor Stephen Kantrowitz

Thesis department(s): History

Certificate(s):
American Indian and
Indigenous Studies

The early 19th century marked a watershed moment in Ho-Chunk history. During this time, the United States government began exerting its influence over the Ho-Chunk homeland in what is today Southern Wisconsin and Northern Illinois. This imposition profoundly changed the way the Ho-Chunk nation interacted with other tribal nations in the region as well as European colonizers. This thesis explores what drove these changes in Ho-Chunk international relations. This work relies on communication between federal Indian agents in the area, parsing through these records to discern a Ho-Chunk understanding of the monumental change occurring at the time. Three specific events are discussed in detail: the initial establishment of Indian agencies throughout Ho-Chunk territory, and with them the first sustained contact between Ho-Chunk communities and the federal government, the arrival of large numbers of lead miners in Southwestern Wisconsin and its effects, and finally an uprising led by the Ho-Chunk warrior Red Bird, in response to white settlement.

KOPP, Kaldan

Positional Reasoning as Part of a Solution to Epistemic Problems

Major(s):
Computer Science
and Philosophy

Advisor(s): John Mackay

Thesis department(s): Philosophy

The problem with being wrong, and being to blame for being wrong seem to be separate issues on the surface. However, with a deeper look, they are one and the same. Traditional epistemology has emphasized truth over all else. However, an analysis of what goes wrong when we are wrong brings a deeper understanding of truth as a whole. How you think, how you are taught, and how you are able to navigate your circumstances will have an impact on whether or not you are to blame for being wrong. Introducing a new quantifier, working with the best information and situation possible to know a proposition, maybe the answer. Using this quantifier in various epistemic problems, and seeing its power, will offer an alternative to traditional views of epistemic culpability. When we are doing our absolute best, it seems wrong to assign blame, even if we are wrong about something.

**KRISHNAN,
Achintya**

Constraining Properties of the Milky Way's Central Supermassive Black Hole via Observations of a Close-Orbit Star

Major(s):
Applied
Mathematics,
Engineering and
Physics (AMEP) and
Astronomy-Physics

Advisor(s): Juliette Becker, Sam Stechmann

Thesis department(s): Astronomy-Physics

A supermassive black hole is thought to lie at the center of nearly every large galaxy in the universe (Kormendy and Richstone, 1995; Kormendy and Ho, 2013). Our own galaxy is believed to be no different; Sagittarius A* (Sgr-A*), a compact emissive source located near the center of our galaxy (Balick and Brown, 1974), is most likely associated with a supermassive black hole (Ghez, 2008). Due to its strong gravity, long-period observations of stellar orbits within the galaxy's central arcsecond can provide valuable constraints on various properties of the central black hole. This work will attempt to build upon previous studies which pioneered this area (Eckart and Genzel, 1996; Ghez, 1998; Ghez, 2005; Ghez, 2008; Gillesen, 2009; etc.). We begin by fitting a 13-parameter Keplerian model to a more robust dataset containing the most recent astrometric and radial velocity observations of the star S2, which closely orbits Sgr-A*. Following this, we append an extended dark matter distribution to the black hole's point mass potential. This model is then fitted to the S2 observational data to constrain the relative importance of dark matter within the galactic center.

KROEGER, Jenna

The Forensic Implications of Sentencing Decisions

Major(s):
Psychology and
Legal Studies

Advisor(s): Chia-Jung Tsay, Lucas Wiscons

Thesis department(s): Psychology and Legal Studies

Certificate(s):
Criminal Justice and
German

The naturalness bias is a preference for people who have natural talent, rather than hard work as a source of achievement. Studies: (1) reasoning defense attorney strategies for achieving lenient sentencing decisions and (2) determining naturalness bias applicability to sentencing decisions. Methods: (1) thematic and conversation analyses of courtroom transcripts and (2) a pilot of an exploratory experiment evaluating defendant (A) the hard-worker or (B) the naturally talented. Preliminary findings suggest a mixture of implicit interaction and overt language produce sentences, meaning the role of the naturalness bias in the legal domain requires further examination. Determining how sentencing decisions are produced implicates defense attorneys interactions, and resulting sentencing decisions affect defendants' life trajectories.

KUHN, Hailey***Traditional Anishinaabe Socio-Ecological Lifeways and Their Present Revitalizations***

Major(s):
Religious Studies
and Environmental
Studies.

Advisor(s): Thomas DuBois

Thesis department(s): Religious Studies

Certificate(s):
American Indian and
Indigenous Studies,
French, and South
Asian Studies

Traditional Anishinaabe and other Native American teachings demonstrate the importance of the natural world alongside human communities. Plants, animals, and elements are sacred teachers and kin. They are used as physical and spiritual food and medicine. Plus, many teachings share the importance of responsibility, humility, and relationships for humans in our interactions with other beings and the environment. Knowledge of practices like ceremonies, handiwork, and preparing foods and medicines is and has often been learned experientially. However, Anishinaabeg's understanding and practice of these teachings and related traditional lifeways have been significantly hindered by colonialism of the past few centuries. Native American communities today face disproportionate levels of mental and physical illness and cultural disconnection as a result of colonial forces. Because of this, countless Anishinaabeg are finding it imperative to undertake revitalization efforts to promote and rejuvenate traditional values and practices for the wellbeing of their communities. In this thesis I examine historic Anishinaabe practices, values, and worldviews pertaining to the environment and how such themes are being brought into the present day as part of Anishinaabe cultural, spiritual, and environmental revitalizations. I focus particularly on Anishinaabe Nations of the Upper Midwest and center Indigenous voices so as to authentically present such perspectives. Furthermore, I consider how the revitalization efforts and historic lifeways inherently involve sacrality and authenticity, and how these phenomena are crucial to people's understanding of such efforts.

KUMAR, Mohan***Neuroimmunology: Mycobacterium tuberculosis (Mtb) Infection reduces NPC proliferation in the Dentate Gyrus in vivo***

Major(s):
Neurobiology

Advisor(s): Matyas Sandor, Thiunuwan Thantrige

Thesis department(s): Zoology

Certificate(s):
Science
Communication

Tuberculosis of the central nervous system (CNS-TB) can be a deadly disease in adolescents, almost always resulting in severe neurological damage and serious disability. Progenitor cells of the CNS that differentiate into almost all the glial and neuronal cell types in the CNS are called neural progenitor cells (NPCs). In this study, we intracranially infected 28-day old mice with Mtb strain H37Rv and quantified NPC proliferation in the Dentate Gyrus (DG). After 4 weeks of Mtb infection, NPCs in the DG region exhibited significantly less Ki67+ proliferating cells compared to the uninfected samples. These findings imply Mtb partially inhibits NPC proliferation in the DG in vivo. NPC proliferation is essential for continuous production and differentiation of neuronal and glial cells, as such differentiation forms the basis for critical functioning of the CNS. However, further research is needed to determine correlation of neurodevelopment defects associated with apparent inhibition of NPC proliferation due to the Mtb infection in the DG in vivo.

KUSHNER, Eva***Conditional Ownership: The Restitution of Nazi-Looted Art and Provenance Ethics in Museums***Major(s):
Art History and
Political Science**Advisor(s):** Anna Andrzejewski**Thesis department(s):** Art History

The purpose of this thesis is to understand and examine the historical roots of ongoing legal issues that heirs of Holocaust victims and survivors continue to face in efforts to regain ownership of their art. Prior to and during World War II, the Nazi Party executed meticulous raids on Jewish homes, looting possessions ranging from kitchenware to sections of wallpaper. Families either had their art stolen by the regime or sold it under duress to escape persecution. After the war, the Artistic Recovery Commission made immediate strides to resolve claims to property, and approximately forty-five years later the 1998 Washington Conference Principles on Nazi-Confiscated Art fortified international non-binding principles signed by forty-four countries on proper restitution conduct. They set a precedent of good faith in auction houses and museums, but as the art industry moves further from the Holocaust, institutions are redefining legal interpretations of 'duress' and international courts are placing a statute of limitations on claims to Nazi-looted art. This thesis research project will focus on United States Museums and spotlight their efforts to accurately document the changing hands of ownership that resulted in the acquisition of each artwork and object in their vast collections. This paper will trace the history of Nazi plunder and its key conspirators to highlight the legal aftermath of their systematic destruction. By analyzing an ongoing case as evidence of the lasting consequences of Nazi looting, this thesis research project will propose a new ethical framework for museum institutions to follow when addressing legal claims for restitution in their art collections.

**LERTWIEIYAPTI,
Sirawit*****Phage-assisted evolution of ribosomally synthesized cyclic peptides for inhibition of a transcriptional repressor LexA autoproteolysis***Major(s):
Chemistry**Advisor(s):** Tina Wang**Thesis department(s):** Chemistry

Antibiotic resistance is a major concern to global public health. One mechanism that causes antimicrobial resistance is the activation of the SOS stress response from DNA damage. DNA damage triggers RecA*-mediated autoproteolysis of LexA, a transcriptional repressor of the SOS response genes, to facilitate DNA repair. This promotes mutagenesis, which contributes to the emergence and spread of antibiotic-resistant bacteria. Inhibiting LexA may be a promising therapeutic strategy to combat antibiotic resistance. Current cell based screening assays are based on a reduction of signal readout as a response to inhibition of RecA*-mediated autoproteolysis of LexA. This RecA*-dependent "turn-off" assay can increase false positives. Here, we designed a "turn-on" genetically encodable biosensor capable of reporting inhibition of RecA*-independent LexA self-cleavage. Next, we demonstrate that the developed biosensor can link the self-cleavage rate of LexA to modulate production of a crucial phage protein. Finally, we leverage the platform to employ phage-assisted noncontinuous evolution (PANCE) technology to discover cyclic peptide inhibitors, making progress towards discovery of inhibitors of LexA autoproteolysis.

LIANG, Andrew***Identifying Mechanisms Underlying Neurodegeneration by Tmem135 Overexpression through Lipidomic Analysis***

Major(s):
Neurobiology and
Molecular & Cell
Biology

Advisor(s): Akihiro Ikeda, Michael Landowski

Thesis department(s): Neurobiology

Certificate(s):
Chinese Professional
Communication

Aging is a known risk factor for many neurodegenerative retinal diseases. To understand how aging perturbs eye health, we use mice with the overexpression of transmembrane protein 135 (Tmem135 TG). Tmem135 encodes a protein that has a role in lipid metabolism important for the retina. When Tmem135 is overexpressed, mice show a neurodegenerative retinal disease that consists of retinal pigmented epithelium (RPE) abnormalities. Interestingly, these neurodegenerative phenotypes are contingent on the genetic background of the mouse. The RPE degeneration was only observed in mice on a C57BL/6J background, not in mice on an FVB/NJ background. In this project, we evaluated the status of lipid metabolism pathways in the Tmem135 TG mice to determine whether there is a link between dysregulated lipid metabolism and neurodegenerative phenotypes in these mice. We found modified lipid profiles between the Tmem135 TG mice on these two genetic backgrounds as well as differences in peroxisomal β -oxidation proteins. In summary, the differences between neurodegenerative phenotypes in the Tmem135 TG mice on these two genetic backgrounds may involve changes in lipid metabolism pathways.

LIN, Ethan***Temporal Tracking of Pancreatic Cancer to Capture Dynamic Response***

Major(s):
Microbiology

Advisor(s): Jeremy D. Kratz

Thesis department(s): Medicine

Certificate(s):
Disability Rights &
Services

Pancreatic ductal adenocarcinoma (PDAC) has poor outcomes due to the inefficacy of systemic chemotherapy, underscoring a critical need for accurate therapeutic predictions to develop new treatments. Patient-derived cancer organoids (PCOs) have been shown to mimic primary tumor biology. In this study, we developed a high-throughput screening platform for PDAC PCOs across a 144-hour course with endpoint staining for apoptosis and necrosis. We also developed novel computational techniques to extrapolate response metrics on the organoid level rapidly. These metrics were then used to define populations with residual viability and biologically inform an optimized dosage of established chemotherapeutic regimens. Currently, we are applying transcriptomics to define additional targeted agents with the primary endpoint of developing a new targeted therapeutic combination to overcome clinical therapeutic failure while minimizing toxicity.

**MAHESHWARY,
Pragati**

***Comparative Analysis of Augmented Reality Landmark-Based Navigation:
Insights from Sighted and Low-Vision Participants***

Major(s):
Computer Sciences
and Psychology

Advisor(s): Suman Banerjee, Yuhang Zhao

Thesis department(s): Computer Sciences

This study evaluates an Augmented Reality (AR) system for assisting low-vision individuals with indoor navigation, focusing on comparing the experiences of low-vision and sighted participants to assess enhancements in spatial awareness, route learning, and navigational confidence. Utilizing highlighted paths, signboards, and icons for various landmarks, the system aims to aid users in forming mental maps and retracing routes. Through controlled navigational tasks, interviews, and surveys, the study examines both groups' navigation strategies and system interactions to identify potential improvements for accessibility and effectiveness. Initial findings show low-vision users prioritize cognitive, visual, and structural landmarks, leading to an AR system that augments these elements to facilitate navigation. This research underscores the importance of user-centered design in developing accessible AR navigational aids, highlighting augmented reality's potential to address navigational challenges faced by low-vision individuals.

**MONTGOMERY-
TAYLOR, Ronan**

***Using Biological Mock Communities to Investigate Bias in the Community
Sequencing of AM Fungi***

Major(s):
Botany

Advisor(s): Kathleen Thompson, Rick Lankau

Thesis department(s): Botany

Certificate(s):
Biology Core
Curriculum

Modern soil community sequencing tools allow for high-throughput characterization of the microbiome. Despite their utility, these tools are still prone to bias in the form of over and underestimation of certain fungal groups. Using a combined in-silico and in lab experimental regime, I have expanded existing understandings of phylogenetic bias in community sequencing protocols. Primer alignment and amplicon length both vary significantly between fungal families, leading to under-representation of key ecosystem components such as AM fungi.

NELSON, Anna***When Feminists Disagree: Pedagogical Responsibilities in Teaching Feminist Theory***Major(s):
Philosophy and
Gender & Women's
Studies**Advisor(s):** Harry Brighouse, Keisha Lindsay**Thesis department(s):** Philosophy and Gender & Women's StudiesCertificate(s):
Art Studio

Feminism is not a monolith. Throughout its history, there exists disagreement between marxist, liberal, radical, and various other feminist schools of thought. Just as conflict exists amongst theorists, students also have various interpretations and applications of feminism. Although the feminist classroom inherently analyzes critiques of the social status quo, there exists a gap between the presence of disagreement amongst students and the practice of disagreeing in the classroom. As seen by pedagogy scholars, this disagreement has powerful influence on students' understanding and engagement with content and democratic participation beyond the classroom. Cultivating and properly navigating disagreement amongst students themselves and making space for students to adequately critique their curriculum, professors, and peers provides opportunity for deeper intellectual analysis. This paper employs a philosophical approach to feminist theory, analyzing its purpose, exploring current classroom dynamics, and providing methods to better encourage student disagreement. Current political discourse already exhibits right wing critique of the feminist classroom from those who argue that these spaces are not emendable to open discussion and debate. To both address these critiques and improve the learning of GWS students, this paper ultimately asks: what are the pedagogical responsibilities when teaching feminist theory in higher education?

NIELSEN, Megan***Epigenetic augmentation of MHCI expression sensitizes tumors to PC-CAR T cells in MHC-deficient models of high-risk neuroblastoma***Major(s):
Genetics and
Genomics**Advisor(s):** Paul Sondel, Amy Erbe-Gurel**Thesis department(s):** Department of Human OncologyCertificate(s):
Biology Core
Curriculum, Health
and the Humanities

High-risk neuroblastoma (HR-NBL) is associated with loss of MHCI expression and an immunologically "cold" phenotype. Guadecitabine (Guad) and Entinostat (Ent) are epigenetic modifier inhibitors (EMis) that provide two mechanisms to restore MHCI expression, enabling integration of immunotherapies. PHOX2B peptide-centric CAR (PC-CAR) T cells offer targeting of tumor-specific proteins presented on MHCI and induce cures in some human NBL cell lines but may not be effective in MHCI-deficient tumors. This study investigates 1) how EMis influence MHC expression and PC-CAR recognition in NBL, and 2) if Guad/Ent can sensitize MHCI-deficient IMR5 cells to PC-CARs. Flow cytometry indicates that treatment with Guad/Ent increases MHCI expression and PHOX2B tetrabody binding at 2, 5, and 7 days in IMR5, SKNAS, CHLA20 and LAN5, but only day 2 for NLF cells. PC-CAR-induced killing—monitored via mKate2 fluorescence—is observed for IMR5, CHLA20, and NLF when treated simultaneously with EMis but only for LAN5 cells when additionally pretreated with EMis. This proves that EMis can augment MHCI expression to facilitate binding of PC-CARs without inhibiting their function. Ongoing in vivo experiments treating IMR5 tumor-bearing NRG mice with Guad/Ent, Mock CARs, and/or PC-CARs will further reveal the efficacy of this combination and inform clinical applications.

**NOMELAND,
Henry**

Interpretable Dialect Classification: A Statistical Modeling Pipeline for Identifying Phonetic Dialect Features

Major(s):
Statistics and Data
Science

Advisor(s): Garvesh Raskutti

Thesis department(s): Statistics

Phonetic variations between dialects are often explored through careful transcription, a review of geographic context, and specialist analysis. Following the development of machine learning techniques, phonetic feature identification can now be accomplished using data-driven approaches. This paper proposes a pipeline that automatically extracts phonetic features, trains classification models, and identifies features that distinguish groups of speakers. Demonstrations utilize random forest and regularized logistic regression models for classification, and variable importance metrics such as mean decrease impurity and permutation importance for model interpretation. F1 and F2 vowel formants from standardized sentences are used for identifying speakers. High intercorrelations between many of these features are addressed. Demonstrations classify American speakers from British speakers and New York City-based speakers from other Americans. Top performing models classify these datasets with accuracies of 94.3% and 84.8% respectively. Interpretation of the UK classifier identifies the /ɔ/ and /ɑ/ distinction in words like 'call' and the /ɑ/ and /æ/ distinction in words like 'ask.' Interpretation of the NYC classifier reveals evidence of short-a raising and other characteristics. This analysis provides a novel and objective way of identifying which phonetic characteristics of speech are most prevalently and prominently different between two groups.

**PEI, "Charles"
Zhengzai**

"World Drifters": Institutional Reform, Illicit Enterprise, and Organized Crime in a Post-Socialist Factory Town, 1985 to the Present

Major(s):
History and Political
Science

Advisor(s): Judd Kinzley

Thesis department(s): History

Certificate(s):
East Asian Studies

The thesis explores how inconsistencies within China's urban institutional reform facilitated the rise of organized criminal activity. Beginning in 1985, municipal governments across the country initiated a series of reforms aimed at transitioning from a socialist system to a capitalist market economy. These reforms encompassed restructuring the state-business complex, establishing entrepreneurial associations, assembling marketplace infrastructures, privatizing state-owned enterprises, and subcontracting law enforcement agencies. Like many other cities, the steel town of Ma'anshan in central China underwent these ambitious yet ill-conceived changes from the late 1980s to the early 1990s. Concurrently, a community of petty hooligans, resourceful profiteers, unrelenting racketeers, illicit tycoons, and corrupted officials formed along the cleavages of institutional transformations. Known as "World Drifters", these illegal agents appropriated lucrative state assets, extorted centralized marketplaces with absentee oversights, and nullified criminal justice with their expansive networks of complicity over the course of the 1990s and the 2000s. Drawing on oral history interviews, local gazetteers, archives, court papers, and newspapers, this thesis reconstructs how criminal actors usurped state projects in China's "Long 1990s" (1989-2008) and assigns historical agency to the former. By unearthing the derailed elements of the Chinese reform, this thesis offers a microscopic perspective to extrapolate the compatibility between collective violence, governance, and residents' way of life in a global moment of urban decline.

PYNE, Lucy***Understanding Influences on Dengue Case Counts Throughout Colombia***

Major(s):
Conservation
Biology and
Environmental
Science

Advisor(s): Paul Block, Max Beal

Thesis department(s): Civil and Environmental Engineering

Viral infections like Dengue are particularly pervasive and harmful in certain areas of the world, namely the tropical and sub-tropical global south. Though disease control and community support in highly affected areas are important, early detection and prevention can be incredibly effective for communities that otherwise do not have access to abundant treatment resources. There are several ways to go about predicting Dengue increases. The most commonly considered influences include natural phenomena such as temperature, relative humidity, precipitation, flood events, and the like. Others include access to healthcare, population density, and travel. These are explored in this study, along with historical influences and anticipatory actions in various locations around the world. Community responses to these actions are assessed in order to best apply similar actions for several communities throughout Colombia. Though evaluating controls on Dengue and planning anticipatory actions is valuable, the community in which they will take place is of primary concern. A combination of external case studies, census data, and environmental conditions in the area provide an understanding of the multi-faceted influences of a region on Dengue case counts while guiding researchers on how to implement early action and warnings most effectively within communities.

RAMIREZ, Aliza***"Barriers Burned Away?": Structuring disaster vulnerability after the 1874 Chicago Fire***

Major(s):
Political Science and
History

Advisor(s): Allison Powers

Thesis department(s): History

Certificate(s):
Gender and
Women's Studies

On a dry July afternoon, a fire ignited in Chicago's Near South Side, devastating a densely populated district laden with wooden frame buildings. Despite the shock of sudden disaster, Chicagoans were no stranger to urban conflagration. It had been only three years since the embers of the "Great Fire," cooled. Unlike the widespread impact of the first conflagration, the destruction of the 1874 fire remained concentrated within an emerging Black Belt and nearby Vice District. Here, questions regarding freedom and citizenship for newly enfranchised Black Chicagoans came to the fore. With attention to the "forgotten fire" of 1874, this thesis demonstrates that the aftermath of disaster became a crucial site where Chicagoans negotiated questions about race, citizenship, and freedom following the Civil War. How – only six years after the 14th Amendment – did race inform how city officials thought about post-fire rebuilding? How did Black Chicagoans negotiate the visions of "urban order" set forth by the municipal government? Amidst a climate crisis with effects borne disproportionately on marginalized communities, these questions will provide readers with an alternative vision of government aid grounded in the experiences, desires, and needs of the city's most impacted members.

ROMANO, Will***Media as a U.S. foreign policy tool: the Cold War in Chile, Cuba and Nicaragua, 1960-1990***

Major(s):
Journalism and
Economics

Advisor(s): Lindsay Palmer

Thesis department(s): Journalism

Certificate(s):
Environmental
Studies

In the United States, a free press is central to the nation's democracy. But abroad, media has been used by the U.S. in certain foreign policy campaigns as a soft power tool to influence political affairs. These schemes include story planting and propagandizing, paying journalists and other tactics. The nature, intent behind, success and political context of these media interventions is the primary subject of this thesis. It includes coverage of the U.S.'s work in Nicaragua to resist the Sandinista regime via pro-democracy publication *La Prensa*, to the C.I.A.'s declassified propaganda efforts in Chile in the 1970s to prevent what the U.S. viewed as a potential communist takeover in Salvador Allende's election efforts. It also chronicles the historic U.S. involvement in media in Latin America in the 1940s, when President Roosevelt's Office of the Coordinator of Inter-American Affairs was used to censor seemingly pro-Nazi or pro-fascist content as a modern interpretation of the Monroe Doctrine.

RUBINOS, Michael***Unsettled Masculinities: Homoeroticism & Orientalizing Tropes in Revolt at Cairo (1810)***

Major(s):
Art History

Advisor(s): Jennifer Pruitt

Thesis department(s): Art History

In the early 19th-century, European imperial ventures into the Middle East gave rise to a popular genre of Orientalist painting, which often depicted an imagined, backwards Middle East, populated by its uncivilized inhabitants. This paper considers one such painting – Anne-Louis Girodet-Trioson's *Revolt in Cairo* (1810), analyzing its treatment of masculinity as central to its Orientalist vision. I argue that this painting simultaneously depicts the Oriental man as hypermasculine and brutal while also imagining an effeminate foreign man, whose emasculation becomes a spectacle for the French audience. I suggest that these contradictory ideas reflect repressed homoeroticism and anxieties surrounding masculinity in French artistic circles of the early 19th century, projecting otherwise inexpressible homoerotic desire upon foreign men in a locale deemed more suitable for abject proclivities.

**SARAVANAN,
Preethi**

Distribution of mesoamygdaloid dopaminergic innervation in hemiparkinsonian monkeys

Major(s):
Biology Major

Advisor(s): Marina Emborg

Thesis department(s): Biology

Certificate(s):
Global Health and
Art History

The amygdala is a collection of nuclei found in the temporal lobe that is primarily involved in the regulation of emotional response, reward processing, and decision making. Each specific nucleus projects and receives fibers to and from different areas of the brain. Parkinson's Disease (PD) is defined as a movement disorder associated to loss of dopaminergic neurons in the mesencephalon, but patients may also present anxiety and depression, which often predate the typical motor symptoms. The mesoamygdaloid dopaminergic (DA) pathway connects DA neurons in the mesencephalon, the substantia nigra (SN), ventral tegmental area (VTA), retrorubral field (RRF), with the amygdala, the same neurons that are affected in PD. The relationship between PD and depression could be due to loss of mesoamygdaloid dopaminergic (DA) innervation. The Emborg Lab has developed MPTP-induced hemiparkinsonian monkey models to study unilateral DA midbrain neuronal cell loss. In this study we have mapped the distribution of tyrosine hydroxylase+ (TH+) DA innervation in the SN, VTA, and RRF of hemiparkinsonian monkeys. This research is able to provide insight on which nuclei of the amygdala has the densest innervation, which can further lead to its effects on depression in PD.

SCOTT, Analea

Investigating Regulation of the Salmonella DMSO Reductases by alternate electron acceptor availability

Major(s):
Molecular and
Cellular Biology

Advisor(s): Johanna Elfenbein, Eddy Cruz

Thesis department(s): Pathobiological Sciences

Certificate(s):
Biology Core
Curriculum

To colonize the hypoxic gut, *Salmonella enterica* reduces alternate electron acceptors to respire without oxygen. In prior work, we demonstrated the *Salmonella* genome encodes a dominant and alternate reductase that supports anaerobic growth with dimethyl sulfoxide (DMSO). However, an understanding of how alternate electron acceptors impact the expression of the *Salmonella* DMSO reductases is needed to model their expression during enteric infection. Utilizing lacZ-transcriptional reporters for the dominant and alternate DMSO reductases, we found that expression of both reductases were enhanced by fumarate but differed in response to trimethylamine N-oxide (TMAO), DMSO, and nitrate. Next, we utilize genetic mutants to test if two-component regulatory systems that sense fumarate, TMAO, and nitrate were responsible for our observed changes in DMSO reductase expression. narXL was required for nitrate-dependent transcriptional suppression of the dominant DMSO reductase. Surprisingly, torRS and dcuRS were dispensable for TMAO- or fumarate-dependent transcriptional enhancement of both DMSO reductases. Ongoing work is investigating how DMSO, TMAO, and fumarate integrate with the two-component system ArcAB, which responds to membrane energetics, to regulate expression of the *Salmonella* DMSO reductases. Collectively, this work suggests that the expression of the *Salmonella* DMSO reductases have distinct transcriptional responses to gut-relevant metabolites.

SENG, Ethan***Engineering of bacterial strains for biosynthesis of biodegradable plastics from dairy waste streams***

Major(s):
Microbiology,

Advisor(s): Erica Majumder

Certificate(s):
Biology Core
Curriculum

Thesis department(s): Bacteriology

Polyhydroxybutyrate (PHB) is a biodegradable polymer produced by bacteria which could replace non-biodegradable plastics. Industrially, PHB is produced using costly food-based feedstocks. Acid whey, a dairy waste stream, may be a cost-effective alternative if bacteria are engineered to grow on it. *Escherichia coli* LSBJ is a PHB-producing strain. It produces PHB in neutral pH, but not acidic pH. We are engineering *E. coli* LSBJ for optimal PHB production in acidic conditions via laboratory evolution and characterizing the adapted strain using growth curves and genomic sequencing. Additionally, *Lactiplantibacillus plantarum* WCFS1 is an acid tolerant food production bacteria which we aim to engineer for PHB production. We are expressing plasmids to demonstrate PHB production in *L. plantarum*, and then plan to optimize PHB production.

SHIRLEY, Carl***STING/AXL Expression States Dictate Type I IFN Response in Melanoma***

Major(s):
Molecular and Cell
Biology

Advisor(s): Nihal Ahmad

Thesis department(s): Dermatology

Despite the unprecedented clinical success of immune checkpoint blockade (ICB) therapy for melanoma treatment, ICB resistance prevails in a majority of patients. Activating the stimulator of interferon genes (STING) can drive a type I interferon (IFN) response to restore ICB sensitivity, but many patients experience STING loss, preventing the success of such strategies. Here, we demonstrate STING re-activation in human melanoma cells reduces expression of AXL tyrosine kinase (AXL), which is implicated in diminishing IFN responses, suggesting AXL may be a STING-loss vulnerability. Surprisingly, we instead found that AXL overexpression combines with STING signaling to enhance type I IFN responses, and AXL small molecule inhibition (AXLi) reduces type I IFN signaling capacity, suggesting AXL may compensate for STING loss and AXLi might not improve ICB-based treatments.

SIEGEL, Alexa***Estimating Probability of Stock Price Movements Across Industries***Major(s):
Statistics and
Finance**Advisor(s):** Alejandra Quintos**Thesis department(s):** StatisticsCertificate(s):
Mathematics

In this research project, we are estimating the probability that, in a small interval of time, at least two stocks fall more than a given percentage. We are also considering significant increases in stock prices for comparison purposes, as an extension of our model. In order to do this, we gathered data for 10 different stocks in a few different industries; namely the technology, hotel, and food industries. This data spans the range of time from 2006-01-03 to 2023-10-20. Since estimating the probability of significant simultaneous decreases or increases in 9 stocks yielded the most computationally efficient final result, we decided to create groups of 9 using our total of 10 stocks. We thus created 10 choose 9 or 10 total groups each containing 9 stocks. This work is based on some results from the paper "Computing the probability of a financial market failure: a new measure of systemic risk" (Jarrow et al, 2022). This insight is crucial for both portfolio managers and investors as it enhances the understanding of stock price shifts and helps to create efficient management of portfolio risk.

STOTT, Kristen***Fibrotic precision-cut lung slices for assessment of radiolabeled probe targeting***Major(s):
Biology**Advisor(s):** Nathan Sandbo, Ksenija Bernau**Thesis department(s):** BiologyCertificate(s):
History

Detection of fibrotic disease activity, especially in pulmonary fibrosis, is challenged by the lack of molecular imaging probes that specifically assess this phenomenon. We are developing a novel radiolabeled probe to allow for the detection of pulmonary fibrosis disease activity by positron emission tomography (PET) based imaging. To do this we are targeting fibronectin, an extracellular matrix glycoprotein that is critical in the development of early fibrosis and may serve as a marker for early disease activity. The probe is a PEGylated peptide (PEG-FUD) that is bacterially derived and targets fibronectin with nanomolar affinity. To assess the specificity of PEG-FUD and determine its capacity as a PET-based probe of pulmonary fibrosis disease activity, we have developed a new *ex vivo* technique that radiographically assesses the targeting of radiolabeled PEG-FUD in living precision-cut lung slices (PCLS). Our results show that during the profibrotic phase of the bleomycin-induced murine fibrosis, ^{64}Cu -PEG-FUD localizes to the injured lung while the ^{64}Cu -PEG-mFUD peptide control does not. We also show an increase in ^{64}Cu -PEG-FUD probe uptake in fibrotic compared to normal lungs. Finally, we decellularized lung sections to demonstrate that our probe specifically targets the fibronectin extracellular matrix.

STUART, Victoria ***Can't Touch This: Exhibition-Making and Imaginative Touch at The Cloisters's 'Heavenly Bodies'***

Major(s):
Art History and
Communication Arts

Advisor(s): Thomas Dale

Thesis department(s): Art History

In 2018, The Metropolitan Museum of Art's exhibition Heavenly Bodies: Fashion and the Catholic Imagination integrated clothing from The Met's Costume Collection into The Met's permanent Medieval art collection at The Cloisters and its Fifth Avenue Museum. The exhibition's record-breaking attendance indicates how curatorial methods of presenting Medieval collections can allow these collections to appeal to a modern mass audience. The exhibition's dressed mannequins acted as three-dimensional sculpture-like forms, and this paper argues that the use of these dressed bodies within the period-room galleries of The Cloisters enhanced the pseudo-sacred and pseudo-medieval environment of The Cloisters. Through museological and embodied aesthetics lenses, this paper analyzes the exhibition-making techniques used in Heavenly Bodies to create a sensory, medievalist performance. Specifically, it examines how the exhibit encouraged the sense of touch – or imagined touch – to create a visceral visitor reaction to the textiles and the rooms as a whole. This investigation contributes to current academic and museological discussions of the role and engagement of Medieval art collections in modern society.

THOLKES, Victoria ***Unraveling the Complexities of Telomerase Regulation by the Telomeric D-Loop***

Major(s):
Biochemistry and
Chemistry

Advisor(s): Ci Ji Lim

Thesis department(s): Biochemistry

Telomeres are the protective end of mammalian linear chromosomes. Human telomeres consist of a repetitive DNA sequence, TTAGGG, followed by a single-stranded DNA (ssDNA) overhang. This overhang can form a telomeric loop (T-loop) which results in the formation of a ssDNA displacement loop (D-loop). The d-loop is thought to be a highly reclusive structure, preventing excessive elongation of telomeres. T-loop formation, and the regulation of overall telomere length is mediated by the widely studied shelterin complex; but the binding affinity of shelterin to telomeric DNA, and the ability of the d-loop to prevent elongation remain unknown. The core shelterin complex includes four proteins and due to the makeup of the complex including ss and ds DNA binding proteins, we hypothesized that there would be a preference for a ss-ds DNA junction. We tested shelterin-DNA binding affinity through fluorescence polarization and confirmed our hypothesis. This confirms that the core shelterin complex does associate with the d-loop. We then found that the ability for telomerase to access the 3' end within the d-loop is sequence dependent through direct assay studies. We have confirmed that shelterin does bind tightly to telomeric DNA, and that the d-loop is a sequence dependent reclusive structure.

THOMA, Ellie

Major(s):
Neurobiology and
Spanish

The Effects of Social Connectedness: From Public Housing & Vouchers to the Classroom

Advisor(s): Seth Pollak, Abbie Klein

Thesis department(s): Psychology

Children living in poverty generally exhibit lower academic achievement, which is likely due at least in part to underlying brain development. The Supporting Families and Academic Success project (SFAS) examines these trends in children of low-income families, both who have received housing assistance and those who remain on waiting lists. In addition to measures of decision-making behavior, academic achievement, risky behavior, health, and well-being, SFAS aims to uncover the neurobiological bases contributing to decision-making, impulsivity, and judgment using fMRI. This project will help isolate factors associated with childhood poverty, which can be helpful in designing intervention strategies. One possible way to remedy students' academic deficits is through improving their sense of connectedness and their level of social satisfaction. This thesis's addition to the project explores participating students' social connectedness through two follow-up online surveys. The results are analyzed in conjunction with student socioeconomic status and SFAS data. The question of whether social interventions targeting students' sense of connectedness can help ameliorate the negative effects of living in poverty is of great importance in the efforts to better support these children. This research aims to inform policymakers of the benefits of housing assistance and social support for low-income students.

TIMM, Halle

Major(s):
Communication
Sciences and
Disorders

Do bilingual children learn new signs better than monolingual children?

Advisor(s): Margarita Kaushanskaya

Thesis department(s): Communication Sciences and Disorders

Research has shown that bilinguals can outperform monolinguals on both verbal and nonverbal tasks, including word learning tasks. However, prior studies have only examined how bilingualism affects novel word learning in the oral modality. This study explores bi-modal language acquisition by testing whether Spanish-English bilingual and English monolingual children differ in how they learn novel words in American Sign Language (ASL). Data collection is ongoing. Three- to four-year-old children learned eight signs in ASL. After viewing videos of the signs with associated pictures, children were instructed to match a sign to one of two pictures. We predict that bilinguals participants will perform better than monolinguals, if bilingual word learning advantage generalizes to a visual modality.

TURNER, Grace***Speech Induced Suppression: Hemispheric Stability and Activity***

Major(s):
Communication
Sciences and
Disorders

Advisor(s): Ben Parrell

Thesis department(s): Communication Sciences and Disorders

Certificate(s):
Disability Rights and
Services

Purpose: Speech induced suppression (SIS) is the phenomenon that describes the difference in the magnitude of the auditory response during both the production and perception of an identical stimulus. Previous literature indicates inconsistent results pertaining to the presence and consistency of SIS in the right hemisphere. Understanding speech-induced suppression patterns in the right hemisphere is essential for unraveling the complexities of language processing, brain plasticity, and related cognitive functions, with implications for both basic science and clinical applications.

Method: Structural magnetic resonance imaging (MRI), magnetoencephalography (MEG), and acoustic data were collected from 15 participants in both listening and speaking conditions. In the speaking condition, participants read the words "ease," "add," or "odd" based on what was displayed on a screen. Subsequently, participants listened to the same words in the listening condition. SIS was determined by calculating the difference in cortical activity in response to sound between the speaking and listening conditions.

Results: There were no significant differences in suppression tendencies observed. The left hemisphere exhibited greater consistency across sessions than the right hemisphere, suggesting the left hemisphere may be more stable than the right. Notably, activity in one hemisphere was not found to be indicative of the other.

UNG, Paige***Effects of Mitochondrial Rcc1-like Gene on Hippocampal Learning and Memory***

Major(s):
Neurobiology

Advisor(s): Corinna Burger

Thesis department(s): Neurobiology

Certificate(s):
Asian American
Studies

The *Rcc1l* gene encodes for the inner mitochondrial membrane protein RCC1L, important for mitoribosome assembly and mitochondrial fusion. Disruption of these processes has been linked to neurodegenerative disorders such as Alzheimer's Disease (AD). To understand the effect *Rcc1l* has on hippocampal learning, memory, and neurodegeneration, we used the Cre-loxP system to ablate *Rcc1l* in the hippocampus and forebrain of mice (*Rcc1l/Camk2a-cre+*). *Rcc1l* knockout (*Rcc1lKO/KO/Cre+*, n=3), heterozygous (*Rcc1lKO/+/Cre+*, n=8), and wild-type mice (*Rcc1lfl/fl/Cre-*, n=5) were evaluated at 3- and 6-months of age in the open field task, radial arm water maze (RAWM), and novel object recognition (NOR) behavioral tasks. At 3 months of age, there was no significant difference between groups. However, at 6 months of age, KO mice, but not heterozygous or wild-type mice, began to show deficits in the NOR task. These results are encouraging, and they likely reflect the progressive nature of neurodegeneration. Additionally, we are currently examining mitochondrial morphology using the ImageJ/FIJI plugin Mitochondrial Analyzer. This is the first investigation on the role of the mitochondrial RCC1L protein on hippocampal learning and memory and provides insight into the influence of mitochondrial dysfunction on memory-associated phenotypes that may be linked to neurodegeneration in AD.

**WEIRSCHKE,
Hollie*****Greater maternal inflammation during pregnancy is associated with reduced subcortical volumes in the infant brain***Major(s):
Neurobiology**Advisor(s):** Sarah Short**Thesis department(s):** PsychologyCertificate(s):
Data Science

Recent studies have established a link between maternal inflammation during pregnancy and the risk of neurodevelopmental and psychiatric disorders in offspring. In this study, we aim to examine associations between maternal inflammation and infant subcortical brain volumes. Using data from a longitudinal human study of mother-infant pairs (n = 68), inflammatory IL-6 levels were collected from the mothers late in the second trimester. Subcortical brain volumes were obtained from infants' MRI scans at about 2 weeks of age. Through multiple linear regression analysis, controlling for gestational age at maternal blood draw, infant sex, gestational age at MRI, and intracranial volume, we found significant negative associations between maternal IL-6 levels and the volumes of critical subcortical regions in neonates, including the basal ganglia ($\beta = -237.96$, $p < 0.005$), striatum ($\beta = -212.96$, $p < 0.005$) and putamen ($\beta = -132.52$, $p < 0.001$). These findings highlight the sensitivity of the developing brain to maternal inflammatory states and open new avenues for research into the mechanisms by which maternal immune activation may influence neurodevelopment and the genesis of psychiatric disorders.

WRIGHT, Oli***The Death of Oiwa and her Centuries of Vengeance: Yotsuya Kaidan Through Time***Major(s):
History and
Japanese**Advisor(s):** Sarah Thal**Thesis department(s):** HistoryCertificate(s):
Archaeology

The ghost story of Yotsuya Kaidan began with the death of Oiwa in the 17th century. Some two hundred years later, the legend of her tragic end and the vengeance she carried out from beyond the grave on those who had wronged her was picked up by Tsuruya Nanboku and dramatized into a vastly popular kabuki play. A few decades after that, the story was told again by a storyteller who told a different version of the story.

There are vastly stark differences between these two main versions, and each was a product of its time period and the format through which the story was told. I am analyzing the historical longevity of this legend, its changes, and its implications. Yotsuya Kaidan makes an excellent case study for understanding the power of stories and how they are affected by time.

YANG, Ethan***School Closure and Family Housing Preferences***Major(s):
Economics and
Mathematics**Advisor(s):** Christopher Timmins**Thesis department(s):** EconomicsCertificate(s):
Computer Sciences
and History

This study explores the shifting dynamics of family housing preferences in response to widespread school closures and the transition to remote work during the COVID-19 pandemic. My research aims to identify how these pandemic-induced changes have influenced families' decisions regarding residential location, space requirements, and housing amenities. In particular, this study attempts to decompose the impact on families' housing decisions into two channels - the demand for children who stayed at home and the demand for parents who changed their employment status in response to school closures. Employing a difference-in-differences approach, I analyzed household-related statistics from the Current Population Survey and housing data from Info USA and CoreLogic datasets from 2018 to 2022, aggregated into the school district level.

ZHANG, Harris***CounterCurate: Enhancing Physical and Semantic Visio-Linguistic Compositional Reasoning via Counterfactual Examples***Major(s):
Computer Sciences
and Data Science**Advisor(s):** Yong Jae Lee**Thesis department(s):** Computer Sciences

We propose CounterCurate, a framework to comprehensively improve the visio-linguistic compositional reasoning capability for both contrastive and generative multimodal models. In particular, we identify two under-explored critical problems: the neglect of the physically grounded reasoning (counting and position understanding) and the potential of using highly capable text and image generation models for semantic counterfactual fine-tuning. Our work pioneers an approach that addresses these gaps. We first spotlight the near-chance performance of multimodal models like CLIP and LLaVA in physically grounded compositional reasoning. We then apply simple data augmentation using a grounded image generation model, GLIGEN, to generate finetuning data, resulting in significant performance improvements: +33% and +37% for CLIP and LLaVA, respectively, on our newly curated Flickr30k-Positions benchmark. Moreover, we exploit the capabilities of high-performing text generation and image generation models, specifically GPT-4V and DALLÉ-3, to curate challenging semantic counterfactuals, thereby further enhancing compositional reasoning capabilities on benchmarks such as SugarCrepe, where CounterCurate outperforms GPT-4V.

ZHANG, Yijing***Methods for domain-specific fine-tuning for generative models***

Major(s):

Advisor(s): Frederic Sala

Computer Sciences

Thesis department(s): Computer Sciences

In machine learning, one fundamental challenge is the scarcity of massive, high-quality, trainable data across multiple domains. Despite, in theory, model fine-tuning poses a promising future solution to address the problem adapting and tuning large machine learning models using generated synthetic datasets, the practical implementation of model fine-tuning maintains significant challenges and concerns, as the efficiency problem during the tuning process still present concerns in the scale of data and computational resource consumption requirement during fine-tuning process. Robust methodologies for evaluating the quality, suitability, trainability and efficiency of synthetic datasets for generative models are essential. This thesis study aims to investigate the trainability performance of synthetic datasets and efficiency performance of different methods of domain-specific fine-tuning for generative models, especially focusing on the domain of medical imaging. We proposed a two-way evaluation pipeline and a new measuring metric to measure the trainability performance of synthetic datasets for generative models. We seek to gain insights into the trainability of the synthetic datasets and the efficiency performance of the fine-tuning model from the measuring tool we proposed.