



Macalester College
Senior Honors Projects

2023

April 28, 2023

Macalester College is fortunate to have an abundance of creative, thoughtful and engaged students. The graduating seniors who have completed honors projects have further distinguished themselves through this accomplishment. They deserve our congratulations and gratitude.

This booklet describes the honors projects completed by the Class of 2023. These compelling and original works, completed under the guidance of dedicated faculty sponsors, were judged worthy of honors by an examining committee in accordance with the standards of their fields. A copy of each project will become part of the DeWitt Wallace Library's permanent collection, joining those completed by previous honors graduates.

It is with great pride I make these achievements public and wish the Class of 2023 the very best in the years to come.

Ann Minnick
Director of Academic Programs and Advising

HONORS PROJECTS

Menal Abdella

Adhesion and Migration of T cells in 2-D Substrates

T cells must navigate various microenvironments of various stiffnesses. To determine the effect of stiffness on T cells, 2-D cell migration experiments were conducted on polyacrylamide gels coated with desired extracellular matrix substrate. There was no statistically significant difference in T cell migration speed across different stiffnesses, which contrasts with data in the literature. There was a very high level of adhesion to the substrate IM7, which suggests that there is a large number of CD44 receptors on the surface of the cell. Ultimately, more work will need to be done to fully understand the specifics of T cell migration.

Honors Project in Chemistry
Advisor: Kelsey Boyle
Chemistry Department

Colleen Waverly Apostle

The Ostrakons of Lethe

Comprising the first half of an epic sci-fi novel, my honors thesis explores the power of mythologies in shaping political realities and what it means to try and eschew old myths in favor of new futures. Nika never wanted to accept the title of Deimarax, god of death and revenge, or the privilege of becoming a patrician, yet nonetheless tried to make it her own. But after failing to thwart her counterpart, Ariston, in his bid to become the next Emperor, she is stripped of her powers and exiled to the icy planet Lethe. There, she meets other exiles who've banded together to survive in spite of Lethe's harsh environment and reunites with her long lost brother, Percy. However, when the suspicious death of Titus causes accusations of espionage to start flying, Nika must re-evaluate her relationship to power as the threat of the Empire draws ever closer. Inspired by Shakespeare's *Titus Andronicus*, I interrogate the efficacy of imperial democracy, complicate depictions of revolution as a series of clear linear events, and instead represent the process of resistance as disciplined intentional practice.

Honors Project in English
Advisor: Emma Törzs
English Department

Julian Regis Applebaum

Gender Between The Lines: How American Courts Negotiate, Authenticate, and Regulate Gender Variant Identities

As increasing numbers of transgender and intersex legal cases reach American courts, a growing body of scholarship has begun to examine how judges and institutions struggle to reconcile gender variance in a system with deeply entrenched gender normativity. Scholars have examined how judges become legal interpreters of gender when presiding over cases concerning transgender inclusion and civil rights, constructing narratives of what it means to be transgender and codifying it as law. This paper presents the first systematic analysis of legal frameworks courts use to adjudicate gender identity. Analyzing 70 judicial opinions from 1966 to 2022, I examine how judges rhetorically describe gender variance and gender variant people to anchor them within deeply entrenched gender normativity. Updating and recontextualizing past scholarship within the current post-Bostock (2020) transgender rights crisis, I advance a typology of four categories of judicial interpretation—biological gender essentialism, medicalism, assimilationism, and deferential to the litigant— and note other rhetorical and juridical trends for interpreting gender variance. I argue that the legal frameworks that most likely lead to a trans litigant's victory are ones which reify the gender binary and pathologize transgender people, and discuss the problematics of that success.

Honors Project in Political Science
Advisor: Patrick Schmidt
Political Science Department

Melody Arteaga

Staircase Packings of Integer Partitions

An integer partition is a weakly decreasing sequence of positive integers. We study the family of packings of integer partitions in the triangular array of size n , where successive partitions in the packings are separated by at least one zero. We prove that these are enumerated by the Bell-like number sequence (OEIS A091768), and investigate its many recursive properties. We also explore their poset (partially ordered set) structure. Finally, we characterize various subfamilies of these staircase packings, including one restriction that connects back to the original patterns of the whole family.

Honors Project in Mathematics, Statistics, and Computer Science
Advisor: Andrew Beveridge
Mathematics, Statistics, and Computer Science Department

Zoe Thorson Battle

Effects of Leaf Litter and Road Salt on Aquatic Macroinvertebrate Colonization and Survival

Aquatic macroinvertebrates are vital to lentic ecosystem functioning because of their importance in food webs, trophic interactions, and complex life cycles. Because adult aquatic macroinvertebrates are often highly mobile, colonization of new wetlands can happen often, and ecosystem characteristics can act as environmental filters on community composition. Road infrastructure located near or through wetlands also poses a significant threat to macroinvertebrates due to a multitude of stressors, including habitat fragmentation and degradation, barriers of movement and gene flow, noise pollution, direct mortality, and light and chemical pollution. Road salt application for deicing during the winter increases the salinity of freshwater ecosystems near roads, and many taxa of macroinvertebrates are extremely sensitive to this change in water quality. Human development can also reduce littoral inputs into aquatic systems via tree removal and deforestation, altering nutrient availability, and habitat spatial heterogeneity in wetlands. Using a multi-factorial mesocosm design, it was found that treatment (control, +salt/CT litter, CT salt/+litter, +salt/+litter) had no significant statistical effects on macroinvertebrate community of individual family abundance. Additionally, treatment conditions did not alter functional diversity significantly. These results suggest that the presence of road salt in this study was either too dilute, the exposure time was too short, or that these taxa do not respond to salinity or leaf litter presence in newly colonized habitat patches. Regardless, the growing alteration of these important habitats requires more examination to fully understand the response of these species to current and future change.

Honors Project in Biology
Advisor: Mary Heskell
Biology Department

Claire Baxter

Inter-Dependence

My honor's project consists of a series of abstract ceramic sculptures emulating organic forms: bodies, trees, coral, and other natural beings. I seek to defamiliarize coil and slab forms in order to emulate energy from an adjacent world, adorned with dazzling surfaces only rarely found in our natural world. The purpose and function of each piece is ambiguous, yet references universal experiences of organic beings such as growth, loss, and rest. Alongside the abstract sculptures is an installation of functional pottery: bowls, cups, and plates in a pile. This installation reflects on the social value of making functional work, as well as my experience of its addictive nature. This project explores tensions of making in the ceramics field in the age of industry, as well as the distinction between functional and sculptural work, and my relationship to it.

Honors Project in Studio Art
Advisor: Summer Hills-Bonczyk
Art and Art History Department

Ana Catherine Berman

Interpreting Spain's Jewish Past: Jewish Heritage Tourism and the Politics of History

This honors project explores Jewish heritage tourism in twenty-first-century Spain and how the politics of historiography permeate all aspects of the tourism experience. It argues that Jewish heritage sites in Spain are deeply entrenched in global, centuries-long historiographical debates about Spanish empire, nationalism and legacy. This, in turn, has shaped decisions about which Jewish spaces Spanish entities preserve for future generations and how Spanish entities represent present-day Jews, Jewishness, and Judaism. To demonstrate the reach of academia beyond the classroom, I use on-site signage, heritage management initiatives, and souvenirs to trace the influence of historiographical narratives, like Spanish Black and White Legend, in the heritage tourism sphere.

Honors Project in History
Advisor: Jessica Pearson
History Department

Mason Samuel Bosley

The Giannis Effect: How Celebrities Impact Prejudice in Their Communities

This paper examines the effect Giannis Antetokounmpo, a Greek-Nigerian NBA player for the Milwaukee Bucks, has had on bias towards immigrants and Black people in Milwaukee and in Wisconsin as a whole. This work is based on the breakthrough 2021 study from Arababa'h et al., which found that Liverpool FC's signing of star Muslim footballer Mohamed Salah dramatically reduced public instances of islamophobia in Liverpool. Using Synthetic Control (SC) and Synthetic Difference in Difference (SDID) frameworks, I implement two methods of analysis to examine Giannis's influence: an examination of Anti-Black and Anti-Immigrant hate crimes in the US, and analysis of Anti-Immigrant google searches in Wisconsin and surrounding states. The results indicate substantial reductions in hate crimes and Anti-Immigrant Google searches in Wisconsin since Giannis was drafted in 2013, though data quality issues make it difficult to draw firm conclusions. This study demonstrates the power of positive Parasocial Contact in changing attitudes and reducing biases.

Honors Project in Economics
Advisor: Mario Solis-Garcia
Economics Department

Lola Isabel Brown

Interpretations of Intent: Sovereignty, the Second Amendment, and US Gun Culture

In this paper, I engage foundational theorists whose ideas about sovereignty underpin the US Constitution and the creation of the Second Amendment. I find that the US Founders' reaction to these foundational theories of sovereignty caused the political culture in the US to move to radical individualism. This radical individualism allowed for the reinterpretation of the Second Amendment, preventing gun violence from being addressed as a systemic issue. Using traditional and contemporary theorists, I waded through all of this discourse in order to propose a more connection-based model of political engagement and gun policy in the United States.

Honors Project in Political Science
Advisor: Lesley Lavery
Political Science Department

Owen Burgdorf-Hibbs

Build-A-Bode

This project reflects my complicated relationship with home and family, elevating fears and insecurities particularly about my own ability to have a healthy home in the future. This, to me, also focuses on the play between the reconstruction of home as a struggle and a gift. *Build-A-Bode* consists of three life size imitation sprue sheets, mimicking the parts found in injection molded plastic model kits created with found objects and PVC. This triptych of sculptural panels focuses on components people ‘break-off’ and bring into their own homes to define and comfort themselves. These “pieces of home” have been grouped into: firstly *security*, secondly *companionship*, and lastly *quarrels*, as what arose as the most emergent themes of home for me.

Honors Project in Studio Art
Advisor: Chris Wilcox
Art and Art History Department

Liz (Xueyan) Cao

Market Concentration and Political Outcomes

U.S. industries have become more consolidated over the past decades. This trend has raised concerns regarding its impact on society. This paper delves into the connection between market concentration and political outcomes. By integrating lobbying data from the Center for Responsive Politics with industry-wide economic data from 2003 to 2019, I utilize several multivariate models to investigate the link between concentration and lobbying expenditures at the aggregate U.S. industry level. I also conduct three representative industry case studies: commercial banks, airlines, and general merchandise stores. The results are mixed. While there is a negative association between market concentration and lobbying expenditures in the overall and airline industry studies, there is a positive relationship in the case of general merchandise stores. I further suggest potential avenues for future research and antitrust policy.

Honors Project in Economics
Advisor: Gary Krueger
Economics Department

Roheyatou M. Ceesay

Fire History Reconstruction of Swiftcurrent Lake in Eastern Glacier National Park, Montana USA

As wildfire frequency and intensity increase due to climate change, understanding how fire history correlates with climate is important for predicting future fires. I examined a 6000-year long lake sediment core from eastern Glacier National Park, Montana to document past fires using charcoal as a proxy. I found a high fire frequency (~one fire every ~100 years) from 4-6ka and from 2ka to present, with a period of low fire frequency (1 fire every ~225 years) from 4-2ka. Periods of higher frequency correlate with the Mid-Holocene Warm Period, the Medieval Warm Period, the Little Ice Age, and the Industrial Revolution.

Honors Project in Geology
Advisor: Kelly MacGregor
Geology Department

Mason Paul Chambal

Comparison of Expanded Panel Testing vs Targeted Testing in Pharmacogenomics: What Are We Missing?

The field of pharmacogenomics (PGx) is a new and rapidly growing area of study aimed at lowering the risk of adverse drug reactions (ADRs) by investigating individual patient genetic variations. These variations alter medication metabolism and affect the efficacy of treatment. Different styles of PGx testing ranging from single gene/drug pairs to expanded panel tests have been developed based on recent need and litigation. This study compares the safety and effectiveness of these varying PGx test types through analysis of the number of potential gene-drug interactions found and reported as well as the number of genetic variations missed within individual patients. This was done with four tests and one list in a 246-patient population, 47 of which were excluded due to having no listed gene-drug interactions. Three targeted PGx tests were used and one targeted list of the seven most genotyped genes in psychotropics. This list was used for comparison only and demonstrated that even the most commonly genotyped psychotropic genes are not sufficient for safety. The expanded panel test is utilized at The Christ Hospital Health Network and was used as the basis of comparison. It was found that targeted PGx testing, testing that focuses on specific gene-drug pairs or clinical areas, is not comparably safe to expanded panel testing which reports on all discovered gene-drug interactions. This is due to the small percentage of potential interactions that targeted testing reported to patients and the substantial amount of potential interactions missed. Targeted PGx testing additionally found less

variations within patients that could become impactful in patient medication management as those unknown variations can lead to ADRs. Future research will expand on these findings and help to show how standard integration of expanded panel PGx testing can greatly improve patient safety.

Honors Project in Biology
Advisor: Elena Tonc
Biology Department

Jackson Codd

Extension of the LUX-ZEPLIN NR Background to 600 phd for Dark Matter Detection

In June 2022, the LUX-ZEPLIN collaboration released its first results, with the most precise measurements of any direct dark matter detector. The findings were calculated using the expected spin-independent WIMP-nucleon interaction model, which would result in small energies deposited in the detector. Therefore, the background of non-dark interactions was calculated for events with S1 areas up to 80 phd (Aalbers et al. 2022). In order to increase the sensitivity to high energy WIMP-nucleon interaction events, as predicted by other models, we extended the non-dark NR background to events with S1 areas of up to 600 phd. We found a large contribution to the NR background from ER leakage. Though the leakage peaked below 80 phd, the leakage rate at 80 phd is roughly 1% for all interaction models, and falls to zero between 150 phd and 200 phd. The expected number of xenon-based MSSI is roughly 0.015 for all spin-dependent interaction models, peaking at high S1 areas. We found the rate of cathode-based MSSI to be zero. The wall based MSSI rate we calculated is significantly higher than is shown by the data, which likely means that the model of the electric field in the detector is incorrect.

Honors Project in Physics and Astronomy
Advisors: John Cannon
Physics and Astronomy Department
Bjoern Penning
Department of Physics at the University of Michigan

Lily Conniff Cooper

Teaching the American Dream: How U.S. Refugee Resettlement Responsibilizes Refugees

My project, grounded in three months' work and research with Jewish Resettlement Services (JRS), shows how US resettlement responsabilizes refugees through policies that teach independence and self-sufficiency while demonizing dependency. Yet, as I illustrate, refugees often *want* to be dependent on JRS. I combine ethnographic insights and discursive analysis to elucidate the contrasting ways in which JRS workers and refugees frame "successful" resettlement. I apply an anti-oppressive lens to show how US resettlement produces "responsible" citizens while evading its own responsibilities to properly support people whom the US has had a major role in displacing. I propose a new framework for resettlement, rooted in solidarity with refugees and in social justice.

Honors Project in Anthropology
Advisor: Jenna Rice Rahaim
Anthropology Department

Ella Chana Anne Deutchman

Yellow

Potent power and vitality reside in our connection to the Earth, music, ourselves, and each other. Drawing inspiration from the raw, coming-of-age albums *Blue* by Joni Mitchell, and *Red (Taylor's Version)* by Taylor Swift, ecofeminism, and Acceptance and Commitment Therapy, the multi-genre anthology "Yellow" aims to make manifest the vibrancy intrinsic in deep attention and attunement to our emotions, the natural world, those whom we love, and exaltation of sadness and longing as vital to our aliveness. Its poems and creative nonfiction attempt to articulate and dance in the golden hour light of coming of age and feeling it all.

Honors Project in English
Advisor: Peter Bognanni
English Department

Rennie Marie DiCarlo

Zircon and Apatite Thermochronology of the Condrey Mountain Dome, Klamath Mountains

The Klamath Mountains Province is an orogen in Northern California and Southern Oregon made of accretionary belts interrupted by a 70,000 km² dome structure centered around the Condrey Mountain Schist (CMS). This thesis aims to constrain the timing and mechanism(s) of the Condrey Mountain Dome through (U-Th)/He thermochronology of surrounding plutons. Our research found zircon and apatite dates averaging 115 Ma and 23 Ma respectively, suggesting two cooling events. We propose an initial Cretaceous burst of cooling due to emplacement of the CMS, followed by a Neogene pulse of uplift forming the dome, likely from the northward movement of the Sierra Nevada into the Cascadia Forearc.

Honors Project in Geology
Advisor: Alan Chapman
Geology Department

Ryan Davis Dodds

Do Right To Work Laws Impact Workplace Safety?

RTW laws allow employees covered by a union who are not union members to choose not to pay union dues. These laws weaken unions and decrease unionization. This study explores the impact of right-to-work (RTW) laws on workplace safety using a two-way fixed effects and a difference-in-differences approach, focusing on the five right-to-work laws passed by states in the 2010s.

For my two-way fixed effects analysis, I construct a panel dataset from 2007-2019 using yearly state-level data from BLS for all 50 states with available data. My outcome variables are nonfatal occupational injury and illness rates and occupational fatality rates. I include state and year fixed effects with a large set of controls. I find that RTW laws reduce unionization and harm workplace safety. Specifically, I find that RTW laws decrease union coverage and membership by about 1.7% and 1.9%, respectively. I find that RTW laws increase occupational fatality rates by about 0.146 per 100,000 employees through decreasing unionization. This number is about 3.5% of the mean occupational fatality rate in my sample and suggests that right-to-work laws cost hundreds of lives each year. I also find, however, that right-to-work laws decrease the rate of reported nonfatal occupational injuries and illnesses by about 6%, and I am able to replicate this finding when looking at specific industries. I find that this decrease is likely being driven by increased reporting in unionized workplaces rather than a true improvement in workplace safety. Indeed, when observing injuries that are less likely to be misreported (including fatalities), I find that RTW laws increase these injury rates.

I am unable to replicate my results in my difference-in-differences analyses comparing recent RTW states to similar states. However, my yearly data is quite suboptimal for difference-

in-differences analyses, and my estimates do not reach statistical significance. My two-way fixed effects estimates are more reliable.

Honors Project in Economics
Advisor: Gary Krueger
Economics Department

A'di A. Dust

Using the Social Model of Disability Studies as a Framework to Assess Deaf-Centered Technology

Deaf and hard of hearing (DHH) users of assistive and adaptive technology have been previously grouped together as one homogenous group, despite the fact that those with deafness and those in the Deaf community are separate groups with different customs and needs. Using mixed methods, this thesis discusses (1) a human-subjects experiment, comparing DHH and hearing interactions with manufacturing collaborative robots, and (2) an interview study with two participants in the Deaf community and two deaf individuals outside of the said community. Finally, analyzing themes from the studies reveals support for the social model of disability.

Honors Project in Computer Science
Advisor: Joslenne Peña
Mathematics, Statistics, and Computer Science Department

Mattie Su Ebbesen

Walton and the *How*: Thoughtwriting and Lyric Poetry's Formal Features

In "*Thoughtwriting – In Poetry and Music*," Kendall Walton suggests the possibility that, in lyric poetry, the reader is invited to view themselves as the expressive subject of the text. If a text is composed for the reader to express their own thoughts, the text is a piece of "thoughtwriting". In this thesis, I analyze various poetic formal features to determine if and how they affect a poem's eligibility as a piece of thoughtwriting. I suggest that a formal feature can affect a poem's eligibility as a piece of thoughtwriting depending primarily on how well the formal feature represents how a reader might express an attitude they have.

Honors Project in Philosophy
Advisor: Hannah Kim
Philosophy Department

Cheikh Fall

Desert Locust Invasions and Farmers' Adaptation

This study measures behavioral changes of Ethiopian farmers after experiencing desert locust invasions in 2014. I use an air-mass dispersion model to predict wind patterns that could transport locust swarms and combine the wind trajectories with a panel household survey data to identify affected households. Exploiting the spatial and timing variation of locust invasions, I find that a marginal exposure to locust swarms during the harvesting season causes farmers to delay planting by 4 days and expand their crop portfolio by 0.115 staple/subsistence crops.

Honors Project in Economics
Advisor: Amy Damon
Economics Department

Ross Adrian Ferguson

Trinification with a Bi-Adjoint Higgs Field

In this project, we propose a novel extension of the Standard Model of particle physics, based on the trinification gauge group $SU(3)_C \times SU(3)_L \times SU(3)_R$. Symmetry breaking is achieved using a bi-adjoint Higgs field (transforming under the left- and right-handed subgroups) along with a more conventional bi-triplet to ensure the correct breaking and pattern of fermion masses. To preserve a discrete Z_2 symmetry (T-parity), we also introduce a right-handed triplet to completely break trinification symmetry to the Standard Model. The minimization conditions and conditions for the boundedness of the potential for this model are calculated. Additionally, the Standard Model quantum charges of the 64-component Higgs field are determined and mass matrices for the gauge bosons are constructed. The survival of T-parity ensures the stability of dark matter candidates in the model; the details of such candidates and the generation of neutrino masses are left to future work.

Honors Project in Physics and Astronomy
Advisor: Saki Khan
Physics and Astronomy Department

Erin Grace Franke

Gentrification and Crime in the Twin Cities: Insights and Challenges through a Statistical Lens

Gentrification is a process of urban redevelopment involving an in-migration of educated people to neighborhoods experiencing disinvestment. While gentrification is regarded for its potential to displace long-time businesses and residents, its impact on crime is controversial. There is no consensus on the relationship between gentrification and crime across criminological theory, and past studies have shown contradictory results. Measuring gentrification from tract level census data, we estimate its relationship with violent crime and theft in the Twin Cities. Using a spatial Poisson model, we find no indication that gentrification is associated with reduced crime. We also discuss broader implications of gentrification.

Honors Project in Mathematics, Statistics and Computer Science
Advisor: Vittorio Addona
Mathematics, Statistics, and Computer Science Department

Valeska Fresquet Kohan

How Do Highways Contribute to Racial Disparities in Air Quality?

While there is extensive literature on the disparate exposures to pollutants such as PM2.5 and NO2, no empirical study has estimated the impact of highways on air pollution as well as their differential effect on minority areas close to interstates. Knowing the extent to which highways exacerbate pollution inequalities is essential to inform policies that reduce vehicle-emitted pollutants, which may also reduce environmental justice disparities. This paper uses spatially-specific satellite estimates at the km2 level from 2015-2020 and Census demographic data to test whether policies that reduce highway emissions would disproportionately benefit minority communities. Using a difference-in-differences specification with time and tract fixed effects, I find that living close to a major road increases exposure to NO2 by 8.3% and PM2.5 by 1.5% on average. In addition, relative to White areas close to interstates, minority areas experience up to 2.3 – 4% higher NO2 pollution.

Honors Project in Environmental Studies
Advisor: Louisa Bradtmiller
Environmental Studies Department

Anna Fromson-Ho

Shaping Sustainability in Classroom Curricula in Singapore: Educators and Students as Collaborative Change Agents

Climate change is a global crisis, and in Singapore, a low-lying city-state, its geography makes it susceptible to extreme weather events, and zoonotic diseases. Singapore's alignment with global commitments like the United Nations Agenda for Sustainable Development is elevated by its presence as a leader in urban sustainability. Using a mixed-methods approach, this paper explores sustainability as a classroom concept and educators' role in translating curriculum standards into learning that informs, educates, and empowers students to become agents of change. Sharing these perspectives will help develop collaborative learning programs that center educators and students, improving understanding of this important field.

Honors Project in International Studies
Advisors: David Moore
International Studies Department
Holly Barcus
Geography Department

Kathleen Ryan Funk

Losing Control: An Analysis of Behavior Changes in Attorneys Before the Supreme Court

Oral arguments before the U.S. Supreme Court offer an important, high-visibility opportunity for legal advocates to shape the decision-making of the Justices. The pressure both of the environment itself and questions by the Justices can cause even the most extensively prepared attorneys to alter their performance. Employing data drawn from oral argument transcripts, this thesis analyzes how advocates change their speech patterns, including tone and emotional intensity, during their appearances before the Court. I pay particular attention to the impact of the Justices' ideology and their gender in generating more adversarial interactions.

Honors Project in Political Science
Advisor: Patrick Schmidt
Political Science Department

Hugh Gabriel

Voyage of Ink and Water

Just trying to make it through the last day of 6th grade before winter break, Arlen and Myriam find themselves falling into the world of Flotsam. Rattling North in a carriage pulled by fearsome Bigmounts, the two adventurers meet Gareth, a swashbuckling boy who may be crucial to their planned return to Earth. The watery passage to the world of Flotsam only opens with Kraken ink—a substance as rare as the circumstances Arlen and Myriam find themselves in. Fleeing giant insects, consulting a yellow-eyed druid, and paddling beneath a hail of bioluminescent arrows, Arlen and Myriam discover that Flotsam is under threat from their connection to Earth. In Voyage of Ink and Water, Arlen, Myriam, and Gareth try to save two worlds at once, all while navigating the waters of their own changing friendships.

Honors Project in English
Advisor: Peter Bognanni
English Department

Emilia Garrido Vasquez

Stim Dancing; The History of Incorporating Neurodivergent Movement in Dance Performance

This paper explores the history of stimming and stim dance, focusing on a neurodivergent perspective and its influences on dance composition. *Stim dance* is the movement that emerges when we permit ourselves to be guided by stimulus with the means to self-soothe, is not limited to a specific form, and can be either choreographed or improvised, encompassing various self-stimulatory and self-regulating movements (stims) (Dye, 2020). The paper aims to explore why stim dance is important for the Neurodiversity Movement (NDM) as both an art form and therapeutic approach by exploring the history of neurodivergence. Neurodivergent artists who express themselves through stim dance will be investigated. Presenting stimming in dance performance brings visibility to outlets of self-regulation for people with self-regulatory disorders (trouble regulating physiological arousal caused by external stimuli), a core feature of many people in the NDM. This paper promotes stim dance as a valuable and inclusive art form that facilitates self-expression and regulation, benefiting many individuals and fostering an appreciation for neurodiversity in the dance community and beyond.

Honors Project in Theater and Dance
Advisor: Wynn Fricke
Theater and Dance Department

Feven Leake Gebresilassie

Radical Imaging: Dicationic Aromatic Diimides Towards Radical-based Near-IR Spectroscopy

The skin and tissue permeability of Near Infrared (NIR) wavelengths introduce a new ground for developing multimodal optical imaging probes. Absorption in the NIR region has been used in emerging photoacoustic imaging (PAI) technology and photothermal therapy (PTT) using non-radiative transitions. One way to achieve NIR absorption/emission is inspired by the narrow band gap of semi-conducting aromatic diimides. These bandgaps can absorb even longer wavelengths when the aromatic diimide enters its radical state through the occupation of a singly occupied molecular orbital. This project aims to synthesize and characterize positively charged aromatic diimides as a precursor platform for stable radicals. Experimental and structural evidence confirmed the formation of the targeted products, and electrochemical evidence demonstrates the reversible redox activity of the product.

Honors Project in Chemistry
Advisor: Dennis Cao
Chemistry Department

David Geeganage

Using Models of Cloud Formation to Address the RH Effect in Low Cost PM Sensors

The growing concern over particulate air pollution and risks it poses to human health have dramatically increased scientific interest in low cost particulate matter sensors (LCPMS). LCPMS have the potential to provide a solution to the spatial, temporal, and financial issues facing air quality monitoring today. However, the operating principle behind these sensors is prone to inaccuracies under different environmental conditions, especially relative humidity (RH). Using existing models that describe cloud condensation nuclei (CCN) activity, I derive a correction factor for the LCPMS readings to account for the influence of RH. This model was tested against an existing correction method, using data collected at the University of Minnesota Particle Technology Lab in an environmental testing chamber, using a Sensirion SPS30 as the LCPMS. While the models did not improve the overall accuracy of the data against a reference DustTrak DRX, the model did succeed in improving the linearity of the data with respect to increasing RH.

Honors Project in Physics and Astronomy
Advisor: James Doyle
Physics and Astronomy Department

Tobias Robin Gilbert

Valuation

My Studio Art honors project seeks to question the delineation between art, craft, and design and the lack of value placed on most everyday objects. While in our society homes are seen as an investment to be maintained and passed down, almost none of the objects that fill said home receive this level of care leading to mass consumerism of objects made merely to fit a function, not to last or hold their value. *Valuation* is a set of dining room furniture made of red oak and white ash accompanied by a full set of ceramic dinnerware and napkins. The table has three large interchangeable ceramic inserts along the center and is flanked by two benches and two chairs at either end. On top of the table is arranged a full set of ceramic plates, bowls, and cups all glazed to match the inserts and a set of accompanying linen napkins. Arranged to create a scene halfway between a home and a showroom with viewers encouraged to interact as much as they wish with the pieces. This project seeks to disrupt the often inaccessible, sterile and imposing nature of modern art galleries.

Honors Project in Studio Art
Advisor: Summer Hills-Bonczyk
Art and Art History Department

Sophia A. Goldberg

Minyan

Minyan is a full-scale art installation that recreates my memory of the synagogue sanctuary my family attended when I was a child. Salient furniture: a bimah, chairs, and a mechitza have been welded from wire and covered in fabric. These items are arranged in their traditional locations, inviting viewers to enter the “sanctuary” space and walk among the furniture. In place of an ark hangs a handmade tallit. The recreation of this familiar space was part of my effort to understand what Judaism means to me and how my identity as a trans and queer person resides within Jewish space. It attempts to capture a complex narrative of identity by mixing adolescent memory with hope for the future.

Honors Project in Studio Art
Advisor: Summer Hills-Bonczyk
Art and Art History Department

Xiu Mei Golden

Investigating Central Sensitization in a Murine Model of Vulvodynia

Chronic pain is persistent pain that lasts well beyond typical healing times and may be induced by the overactivation of neurons due to repetitive noxious stimuli. Inflammation has also been reported to play a role in the development of chronic pain through neuronal and immunological cross-talk. Inflammatory mediators can lower the firing threshold for pain neurons leading to their persistent activation and the strengthening of these pathways, which increases pain perception. We employed an allergy-driven murine model of vulvodynia to determine the relationship between chronic pain development and inflammation. Using a standard chemical preservative, methylisothiazolinone (MI), female mice were allergically sensitized with MI on the flank and subsequently challenged with MI or vehicle for ten consecutive days on the labial skin. In this model, repeated challenges induce transient production of inflammatory mediators and long-term sensitivity in the genital region of mice. We have now examined the expression of inflammatory mediators that can lead to central sensitization and thus be involved in the maintenance of chronic pain in the spinal cords of challenged mice at various time points after ten challenges. While upregulation of inflammatory markers, IL-6 and IL-1 β , is not significantly different during the first 21 days after the tenth challenge between MI and AOO mice, there is a trend towards increased expression of central sensitization marker NK-1 in MI-challenged mice one day after ten challenges. In addition, upregulation of CGRP and TLR4 markers was seen across both treatment groups compared to untreated mice. An increased understanding of inflammatory-induced pain mechanisms can aid in the study of other inflammation-associated chronic pain conditions and may lead to the development of more effective therapeutic strategies for chronic pain management.

Honors Project in Neuroscience

Advisors: Elena Tonc

Biology Department

Devavani Chatterjea

Biology Department

Sarah Hamilton

Addressing the Complexity of Mental Health Care for Youth Experiencing Houselessness

Children and youth experiencing houselessness have a unique set of mental health needs due to the traumatic experience of houselessness during childhood and the other adverse childhood experiences that often coincide with houselessness. They face immense barriers in access to mental health care due to logistical factors as a result of their housing status and socio-structural factors. Thus, this paper seeks to investigate the mental health needs of children and youth experiencing houselessness and the extensive barriers they face in accessing mental health care through a review of the literature and subsequent qualitative research with mental health providers. Existing studies reveal a lack of evidence-based interventions for children and youth experiencing houselessness and an absence of insight from mental health providers for this population, despite these providers having the best understanding of their needs, thus highlighting the practice-research gap between providers and researchers. The qualitative research conducted in this project, in the form of interviews with two mental health care workers, demonstrates the importance of fulfilling basic needs and considering broader social context, specifically systemic racism, as the most significant factor in mental health concerns.

Honors Project in Psychology
Advisor: Jaine Strauss
Psychology Department

Hanna Rose Harbison Ruedisili

Investigating the Psychology of Morbid Curiosity: The Role of Needing to Know

This study investigated the psychological factors that motivate morbidly curious behavior, specifically the cognitive drive to learn about potentially dangerous (morbid) situations, such as the aftermath of an automobile accident. Participants were shown a variety of morbid and non-morbid images, either with a preview or without. Gaze durations on morbid content were significantly longer compared to non-morbid images, but that effect disappeared when a preview of the morbid image was provided. The results are consistent with the hypothesis that the drive for novel information about morbid content is an important motivator for morbidly curious behavior.

Honors Project in Psychology
Advisor: Brooke Lea
Psychology Department

Quentin Royal Harrington

Future City

Techno-Utopianism, meritocracy, and free market dogmatism build an ideological justification for vast and growing wealth inequality worldwide. The futuristic city skyline is a popular techno-utopian symbol of the world they want to create. My work juxtaposes the awe and allure of the future city motif with dramatic representations of the structural exploitation and expropriation that enables the system to function. Techno-Utopianism dangerously advocates for rapid technological advancement without acknowledging the present and historical reality of its usage as a vehicle for the accumulation and consolidation of political power and capital. The series concludes by providing alternative visions of future social organization and technological progress that center sustainability, flexibility, and durability.

Honors Project in Studio Art
Advisor: John Fleischer
Art and Art History Department

Elyse Yolanda Hatch-Rivera

Expanding Carceral Frontiers: The 100-Mile Border Zone and Constituting Latinx Political Subjectivity

The thesis has two interrelated concerns. The first explores the emergence of the 100-mile border zone in order to study how the U.S. has expanded its borders inward and redefined notions of national security and carcerality. The second will define the 100-mile border as a *carceral frontier* that has emerged from previous years of racial security operations such as “Operation Wetback” in 1953. Moreover, I will demonstrate how the 100-mile border zone, a carceral frontier, blends the logic of security and the carceral in order to create a space of total state control. This inward turn of the 100-mile border zone and the security and carcerality of this space reveals much about the constitution of the sovereign state’s right to define and secure its borders within the nation, the rights of the state over that of the citizen, a citizen's right to free movement and due process, and the racial dynamics of security actions. To explore this contradictory logic of security, I conduct an analysis of security language on border and immigration “operations” that constituted the emergence of the 100-mile border zone since 1953. Through this analysis, I will argue that the 100-mile border zone, as a carceral frontier, is a new theoretical development in Critical Carceral Studies. In this way, this thesis will engage in Securitization Studies, Border Theory, and Carceral theories. This type of analysis will reveal that the 100-mile border zone, and the making of this carceral frontier, is inextricably bound to the rights and status of Latinx.

Honors Project in Political Science
Advisor: Paul Dosh
Political Science Department

Jonathan Irvin Hauser

Investigating the Effect of a Rare Variant of SIRT6 by Humanizing *Caenorhabditis Elegans*

Recently, a rare variant of the human gene Sirtuin 6 (SIRT6) called centSIRT6 was found to be enriched in Ashkenazi Jewish (AJ) centenarians relative to AJ control individuals. The aim of this study is to determine whether human centSIRT6 functions to increase lifespan in the free-living nematode *Caenorhabditis elegans*. Using the strengths of CRISPR–Cas9, we were able to generate humanized strains of *C. elegans* containing both centSIRT6 and wild-type SIRT6 in place of SIR-2.4, the homologous gene in the worm. Our preliminary data indicate that the centSIRT6 variant is associated with increased lifespan relative to wild-type SIRT6 ($p < 0.005$) in *C. elegans* at 25°C, although more replicates are needed to confirm this finding. These humanized strains will be integral to the further study of the role of SIRT6 in both lifespan and healthspan.

Honors Project in Biology

Advisors: Robin Shields-Cutler

Biology Department

Matthew Gill

University of Minnesota’s College of Biological Sciences

Abdirahman A. Hayir

Effects of Diet on LCN2 Expression and Onset of Neuroinflammation in an Alzheimer’s Disease Mice Model

This project covers the findings regarding the impact of diet on lipocalin 2 (LCN2) and the effects it has on neuroinflammation Alzheimer’s Disease (AD). LCN2 is a protein that is critical to the functionality of mitochondria and inflammatory responses. Evidence has shown that mitochondrial dysfunction is a potential central event in driving AD pathogenesis and contributing to formation of pathological hallmarks such as chronic inflammation. Furthermore, studies have shown that LCN2 can be deficient under metabolic conditions such as high-fat-diet (HFD). This study investigates if HFD induces LCN2 deficiency and increased neuroinflammation in an AD mouse model.

Honors Project in Neuroscience

Advisor: Darcy Burgund

Neuroscience Program

Haley Lokahi Andrews Heine

Using Ultraconserved Elements to Delimit Cryptic Species in the New Zealand-Aotearoa Harvester *Aoraki denticulata*

Aoraki denticulata, a widespread mite harvester species endemic to the Southern Island of New Zealand, has been shown to have high levels of genetic divergence between populations despite a lack of clear morphological differences. The association of deep genetic divergence and geographic structure coupled with morphological conservatism indicates that there may be a complex of cryptic species within *A. denticulata*. Previous studies have utilized Sanger sequencing, which limits the number of loci that can be sequenced and analyzed. Because this method has been exhaustively applied in this system without resolving cryptic species limits, we used target-enriched sequencing using ultraconserved elements to reconstruct phylogenies and conduct our analyses. In total, we sequenced two outgroup taxa and 115 *Aoraki* specimens, including museum specimens that otherwise would not have been able to be sequenced due to degraded DNA. We recovered 852 and 651 loci at 50% and 75% taxon coverage, respectively. We explored potential cryptic speciation in this lineage using multiple genetic species delimitation analyses, including machine learning techniques. Our findings confirm that *A. denticulata* exhibits deep genetic divergences and shows strong population structure; we retrieved multiple cryptic species within *A. denticulata*, each with a distinct geographic range. These results are promising for resolving the species status within one of the most difficult cryptic species complexes known in Opiliones.

Honors Project in Biology
Advisor: Sarah Boyer
Biology Department

Jonah Henkle

Deconstructing the University: Contemporary DEI, Neoliberal Rationalities, and the Abolition of the Administrative Apparatus

The following chapters attempt to develop some working theories to combat capitalist exploitation and racist and gendered oppression in the university, culminating in a call for the abolition of the university's administrative apparatus. The project is divided broadly into two parts, which are referential to each other, but maintain slightly different areas of focus. Part 1 details a preliminary critique of the political-economy of the contemporary neoliberal university, drawing influence from Marxian economics and structuralist theories of ideology, critiquing contemporary discourses of diversity, equity and inclusivity (DEI). Part 2 focuses more directly on issues pertaining to oppression and difference, maintaining a predominantly Marxist critique which situates racism and patriarchy as co-constitutive of capitalist social relations. The project's

conclusion, seeks to join the theoretical developments of Parts 1 and 2 into a singular political mission: abolition.

Honors Project in Media and Cultural Studies
Advisor: Tia-Simone Gardner
Media and Cultural Studies Department

Aurora B. Hiveley

A Forest Building Process on Graph Families

For a simple, connected graph, we consider the forest building process in which all edges are randomly ordered, and an edge is kept in the reconstruction if and only if it is incident to at least one vertex which is not incident to any preceding edges. The resulting spanning forest is characterized by a number of trees or components, and we prescribe a general formula for the number of permutations producing any number k components on a path P_n . We similarly present formulas for the number of permutations producing exactly 1 component on graph families including brooms, spiders, and lassos.

Honors Project in Mathematics, Statistics and Computer Science
Advisor: Kristin Heysse
Mathematics, Statistics, and Computer Science Department

Ari D. Holcombe Pomerance

Mixing Measures for Trees of Fixed Diameter

A mixing measure is the expected length of a random walk in a graph given a set of starting and stopping conditions. We determine the tree structures of order n with diameter d that minimize and maximize for a few mixing measures. We show that the maximizing tree is usually a broom graph or a double broom graph and that the minimizing tree is usually a seesaw graph or a double seesaw graph.

Honors Project in Mathematics, Statistics and Computer Science
Advisor: Andrew Beveridge
Mathematics, Statistics, and Computer Science Department

Sophia R. Holland

Ellipsis as Form in Isaac Babel and Akutagawa Ryūnosuke

How can the unspeakable be represented? In texts by Isaac Babel and Akutagawa Ryūnosuke, the ellipsis serves as a form of resistance to linguistic standardization and the aspiration towards totalizing systems of knowledge. Not merely punctuation, ellipsis is rather the narrative mode that allows for the inclusion of omission in works by both authors. This thesis explores the representations of marginalized experience that the ellipsis enables, resulting in non-instrumentalizing representations of trauma; the reconfiguration of historical consciousness into the form of animate residue; the transformation of limits into spaces where the presence of absence allows communion with the unborn other.

Individually Designed Interdepartment Honors Project

Advisors: Arthur Mitchell

Asian Languages and Cultures Department

Julia Chadaga

German and Russian Studies Department

David Martyn

German and Russian Studies Department

Sophia Rose Kaufmann

Un-Scene: How Responses to Sexual Violence Reproduce Legal Hegemony in the Bay Area's Punk and DIY Community

Sociologists understand law as constitutive order that expresses solidarity and contributes to structural inequality. Yet, some communities seek to change existing orders and as Kathryne Young argues, cultivate a resistant collective identity. Drawing on legal consciousness theories, I examine the Bay Area DIY music scene as it addresses community members' experiences with sexual violence without involving the legal system. I interviewed 28 community members and found that although they aim to resist law in favor of transformative justice, their resistant collective identity leads them to reproduce legalistic punishment through their response to sexual violence. Scene members told three intertwined cultural narratives about accountability: 1) scene members invoke the legal system to distance themselves from sexual violence; 2) they utilize punitive tactics that provide catharsis and solidarity; 3) they invoke reified images of law to legitimize an individualistic approach and create an illusion of order.

Honors Project in Sociology

Advisor: Erik Larson

Sociology Department

Emmanuel Ellsworth Keppel

New Americans and the New Right: Hispanic Voting Trends in the "Trump Era" of Politics

Over the past seven years— as some might call it, the “Trump age of politics”—, the United States has undergone a vast political shift. As we have seen discussed hundreds of times in the political sphere recently, white rural areas are growing more conservative while upscale suburbs are becoming more liberal. However, in the 2020 election cycle, one group’s shift was even more pronounced. While rural/suburban shifts continued, those shifts paled in comparison to the rightward lurch of Hispanic voters. Perhaps no county is more indicative of this trend than the most Hispanic county in the United States: Starr County, Texas, a county of 65,000 in which 97.7% of residents identify as Hispanic, gave Joe Biden a narrow 52-47 victory just four years after backing Hillary Clinton by a 79-19 margin just four years prior¹. However, this trend goes far beyond just one county, with Hispanic counties and neighborhoods across the country crossing over to vote for a Republican President who had backed some of the harshest immigration policies in recent memory².

This paper will examine how the concerns of Hispanic voters go far beyond immigration policy, and discuss the ways in which the Republican party gives an intriguing home to many Hispanic voters. I will argue that this includes people who value religion and family values or are skeptical of the government’s representation of their interests. It will also look into the way the Democratic establishment’s outreach towards Hispanic communities has fallen short, making voters who don’t actively seek out political information (known as low information voters) more susceptible to only seeing conservative narrative. These topics will be framed through a series of city case studies which will provide a more in-depth look at the way national shifts play out at a local level.

Honors Project in Political Science
Advisor: Julie Dolan
Political Science Department

¹Park, Alice, Charlie Smart, Rumsey Taylor, and Miles Watkins. “An Extremely Detailed Map of the 2020 Election.” The New York Times. The New York Times, February 2, 2021.
<https://www.nytimes.com/interactive/2021/upshot/2020-election-map.html>

¹Anderson, Stuart. “A Review of Trump Immigration Policy.” Forbes. Forbes Magazine, April 14, 2022.
<https://www.forbes.com/sites/stuartanderson/2020/08/26/fact-check-and-review-of-trump-immigration-policy/?sh=6ec995fd56c0>.

Shaherazade N. Khan

Using *Ginkgo biloba* to Test the Franks Method of Estimating CO₂ Levels in Deep Time

Among paleoclimate proxies are methods to target ancient concentrations of atmospheric CO₂, a gas crucial to understanding climate trends but difficult to trace in the geological record. We tested the Franks et al. (2014) model of reconstructing atmospheric CO₂ concentration from anatomical and chemical attributes of *Ginkgo biloba* trees. *G. biloba* plants were grown under ambient and elevated CO₂ concentrations for multiple years in outdoor, open-top chambers. Measurements of the stomatal morphology and other attributes of leaf gas exchange were run through the Franks Method to produce estimates of CO₂. Alternative methods for improving the model are also discussed.

Honors Project in Geology
Advisor: Raymond Rogers
Geology Department

Stella Drew Kirszner

Hiding and Hoarding: How the New York City Public School Application Process Reinforces Privilege and Inequality

New York City's infamously segregated public school system (Shapiro 2019) requires application for admission to public middle and high schools. Although applications suggest that meritocracy governs admission, patterns of admission suggest otherwise. I examine admission patterns and how the NYC public school system reproduces inequalities under the guise of meritocracy. This research is grounded in Bourdieu's concepts of cultural capital and social reproduction. I also build on Charles Tilly's work on opportunity hoarding by analyzing the tools that the wealthy use to create and maintain inequalities in the NYC public school context. I analyzed demographic data including race, gender, and socioeconomic status of students from the 2021-2022 school year from all public middle and high schools in New York City. I found that an increase of students in economic need is a strong predictor of that school having fewer applicants per seat for both middle and high schools. This blatantly contradicts meritocratic ideals as it shows that low-income students are largely ending up in low-demand schools. I also analyzed the website of a costly consulting service run by a New York City parent in comparison with the free website provided by the NYC DOE to gain insight on the resources available only to affluent New Yorkers. My findings show that opportunity hoarding is especially effective within bureaucratic systems that tout meritocracy because those with the means to avoid

meritocratic methods-such as proving resilience and hard work will pay to do so. As home to the largest public school system in the nation (NYU Steinhardt 2022), it is vital that New York City implements a process that equally serves all students, regardless of their resources.

Honors Project in Sociology
Advisor: Erik Larson
Sociology Department

Jonah Flynn Klein-Collins

Zooming Out: A Retrospective Analysis of Nontraditional Learning Modes' Effect on High School Graduation and Dropout during the 2020-2021 Covid-19 School Year

This paper examines the impact of nontraditional learning modes, such as online education, on high school graduation and dropout rates during the 2020-2021 Covid-19 school year. Using school-level data from the Illinois Report Card for 2012-2021, a difference-in-differences framework is used to estimate the average treatment effect of two groups: schools that used virtual learning modes for only part of the year and those that used it for nearly the entire year. The study reveals that virtual learning had a negligible effect on four-year graduation rates. However, schools that used virtual learning for only part of the year witnessed a decrease in dropout rates by 0.5%, while those that used it for the entire year experienced a 1% reduction. These results suggest that virtual education and non-traditional learning modes provide greater accessibility to students, particularly during the Covid-19 pandemic, but may be less efficient than traditional in-person schooling. Overall, the study offers insights into the effects of virtual learning modes and highlights the need for further research in this area.

Honors Project in Economics
Advisor: Liang Ding
Economics Department

Xueyi Li

Molecular Line Search in M87 ALMA Archival Imaging

We present a molecular line search in spectral imaging of the elliptical galaxy M87 using archival data from the Atacama Large Millimeter/sub-millimeter Array (ALMA). The primary goal of this project is to verify and characterize possible CO transition lines. These lines can be used to determine the dynamics of the system and the mass of the supermassive black hole (BH) in the center of the galaxy. After performing extensive atmospheric modeling, we found that most of the absorption features have a corresponding atmospheric ozone transition. It is unlikely

that these features are either Galactic or extragalactic in origin. We also found and corrected a calibration error that introduced an overly sharp absorption feature. This suggests that future studies regarding pre-calibrated data sets should be mindful of possible calibration errors that could potentially affect the transition line strength significantly. After careful continuum subtraction, we calculated line strengths of identified absorption and CO emission lines from high-velocity gas very near the central BH. These transition lines were used to study the hydrogen column density along the line of sight. We also derived gas dynamics, like centripetal velocities and distances of the CO clouds, with respect to the galactic nucleus. After analyzing the CO absorption and emission properties, we present a pathway forward for future spectral imaging programs of M87.

Honors Project in Physics and Astronomy
Advisor: Anna Williams
Physics and Astronomy Department

Madeline Medina

Examining the Role of Place Attachment in Climate Justice Engagement and Jewish Relationships to the Environment

It is critical that environmental justice and marginalized identities are the focus of climate-related discussions and research. Solutions must support the long-term wellbeing of people, especially and importantly those who are most vulnerable to the consequences of climate change. Psychological research suggests that place attachment—the meaningful bonds that occur between people and their environment (Scannell & Gifford, 2010)—is a key factor in motivating environmental behavior, but little research has examined its connection to environmental justice oriented behavior. This two-part exploration first evaluated the role of place attachment on engagement with both a typical climate change centered message and a climate justice message (Study 1), and found that there was no effect of message condition on engagement with climate issues. Study 2 used a grounded theory approach to explore identity-specific place attachment bonds, and investigated Jewish relationships to place to develop an understanding of Judaism-based environmental justice engagement. Study 2 generated a set of recommendations for future Jewish community action as the effects of climate change become more observable.

Honors Project in Environmental Studies
Advisor: Christie Manning
Environmental Studies Department

Lou Henry Miller

Using Cesium-137 to Determine Sedimentation Patterns in Two Proglacial Lakes - Lago Argentino, Argentina and Lake Josephine, Montana, USA

Glaciers dominate bedrock erosion in alpine settings, and sediment deposition in proglacial lakes produce complex spatial and temporal records of glacier dynamics. Atmospheric fallout of cesium-137 has been used as a tracer for modern lake sediment age and deposition rates. I analyzed a downvalley transect of cores from two proglacial lakes: 1,415 km² ice-contact Lago Argentino in Argentina, and 0.54 km² Lake Josephine in Montana downvalley of a cirque glacier. Cesium-137 concentrations were 5-10 times higher in Lake Josephine, consistent with observations of fallout in the northern hemisphere. Sedimentation rates decreased with distance from the glacier terminus in both systems: 19.4 mm/yr to 0.54 mm/yr in Lago Argentino, and 3.73 mm/yr to 0.21 mm/yr in Lake Josephine.

Honors Project in Geology
Advisor: Kelly MacGregor
Geology Department

Kari Diane Myhran

A Comparative Taphonomic Analysis of the Bug Creek Anthills Microfossil Bonebed, Hell Creek Formation (Cretaceous), Northeastern Montana

The Bug Creek Anthills (BCA) microfossil bonebed in northeastern Montana occurs in the upper Hell Creek Formation (Maastrichtian) near the Cretaceous-Paleogene boundary. BCA is a fossiliferous channel-fill deposit that yields remains of aquatic, semiaquatic, and terrestrial animals. Importantly, the site preserves both dinosaurs and Paleogene mammals. This fact has led to controversy regarding what the site implies about the end of the Cretaceous - was the extinction gradual or catastrophic, and did dinosaurs survive across the boundary? To date, the taphonomy of the BCA has not been investigated in detail. If the taphonomy of the deposit is not uniform throughout, collecting fossils randomly could produce biased results with regard to the mixing of pre- and post-extinction faunas. I analyzed microfossil content over eight 20-30 cm thick increments within the site. Fossil richness varied throughout the BCA, while evidence for fossil reworking was consistent. Dinosaur fossils were only recovered from the lower half of the BCA, indicating that taphonomy and stratigraphic location are important considerations for reconstructing faunal diversity patterns across the end-Cretaceous extinction boundary.

Honors Project in Geology
Advisor: Raymond Rogers
Geology Department

Kanon Nakajima

Effects of Coordinated Reset Deep Brain Stimulation of Subthalamic Nucleus on Parkinsonian Gait in the Non-Human Primate Model

Parkinson's Disease (PD) is a neurodegenerative disorder that affects over 10 million people worldwide. Deep Brain Stimulation (DBS) has been a successful treatment for advanced PD, however, can be accompanied with current spread related side effects. Coordinated Reset (CR) DBS is a novel therapeutic approach that could reduce the risk of side-effects by using lower current. Previous research has shown therapeutic effects of CR DBS on PD motor symptoms including akinesia, bradykinesia, rigidity, and tremor that sustained after stimulation cessation (i.e., carryover effect), however its effect on gait dysfunction is unknown even though it can be one of the most difficult symptoms to treat. The goal of this study is to investigate the carryover effect of subthalamic CR DBS on PD gait. Two non-human primates (NHP) were rendered parkinsonian and implanted with a DBS lead in the subthalamic nucleus (STN). Each subject received STN CR DBS for 2 hours per day for 5 consecutive days. Gait was quantitatively assessed before and after the stimulation using a gait testing apparatus. A modified clinical rating scale (mUPDRS) was used to monitor carryover effects on other motor symptoms. Moreover, in one NHP, the differential effects of CR DBS using two additional burst frequencies were also explored. Our results showed that STN CR DBS induced carryover improvement in gait as well as in other symptoms. We also identified a significant impact of varying burst frequency on the effect of CR DBS in gait given that one burst frequency produced greater gait improvement than the others. Although preliminary, this study encourages the further advancement of CR DBS and emphasizes the importance of customizing parameter settings of CR DBS to treat specific symptoms of PD.

Honors Project in Neuroscience
Advisor: Darcy Burgund
Neuroscience Program

Lauren Abigail Natkin

The Effect of the Minimum Wage on Crime

Evidence shows that education, labor market conditions for ex-offenders, and wages influence crime rates. The relationship between wages and crime specifically has interesting potential policy implications, especially in arguments for increasing the minimum wage. Economists speculate that increasing the minimum wage may help reduce crime by increasing wages and thus increasing the opportunity cost of committing crime, making it riskier and less necessary for people to supplement their incomes through illegal avenues. Using crime data from the FBI's Uniform Crime Reports and minimum wage data from Vaghul & Zipperer (2016), I employ a two-way fixed effects framework to analyze the effects of changes in the minimum-to-median wage ratio on various crime outcomes, including total crime rates and 16–24-year-old

crime rates. I find no effect on Core-Based Statistical Area (CBSA) crime rates with changes in the minimum-to-median wage ratio.

Honors Project in Economics
Advisor: Sarah West
Economics Department

Lia Catherine Pak

Who Shapes the Pandemic Narrative? A Bibliometric and Experimental Analysis of Public COVID-19 Experts

Scholars have long argued that interdisciplinary research is crucial for solving multifaceted problems like the COVID-19 pandemic. However, these arguments rest on an untested assumption: that the combination of diverse disciplines actually produces different information and results. My thesis is the first systematic study to address the question of how interdisciplinary expertise shapes public health organizations' COVID-19 responses. First, I create an original dataset of COVID-19 publications from three multinational health organizations and identify their most prevalent topics using a structural topic model. Then, I analyze whether interdisciplinarity influences how authors write about COVID-19 in these publications. Finally, using a conjoint experiment I explore whether interdisciplinarity and other background characteristics influence how people perceive public-facing COVID-19 experts. I find that interdisciplinarity is important for some aspects of COVID-19 research but not most, and that the public has some interest in policy guided by interdisciplinary teams. These results can help public health personnel decide how much to prioritize interdisciplinary perspectives in their research and communication, with respect to COVID-19 or otherwise.

Honors Project in Political Science
Advisor: Lisa Mueller
Political Science Department

Natalie Clayton Parsons

Negotiating Arabic: Diglossic Language and Intercultural Proficiency in American Education

Diglossia refers to the coexistence of High (H) and Low (L) varieties within a language (Ferguson 1959). Arabic, a diglossic language, struggles with this division. Native speakers of Arabic communicate via their dialects (L). Teaching Arabic as a Foreign Language (TAFL) in the US focuses on Modern Standard Arabic (H), neglecting the dialects. US government

investment in Arabic as a critical language since 9/11 has continued to prioritize the H variety, suppressing intercultural proficiency. Arabic Language curricula in the US must evolve to teach the meta-linguistic awareness between the H and L forms of Arabic.

Honors Project in International Studies
Advisor: David Chioni Moore
International Studies Department

Anina Finkel Peersen

A Brascamp-Lieb–Rary of Examples

This paper focuses on the Brascamp-Lieb inequality and its applications in analysis, fractal geometry, computer science, and more. It provides a beginner-level introduction to the Brascamp-Lieb inequality alongside related inequalities in analysis and explores specific cases of extremizable, simple, and equivalent Brascamp-Lieb data. Connections to computer science and geometric measure theory are introduced and explained. Finally, the Brascamp-Lieb constant is calculated for a chosen family of linear maps.

Honors Project in Mathematics, Statistics and Computer Science
Advisor: Taryn Flock
Mathematics, Statistics, and Computer Science Department

Lanise Yavonne Prater

Quiet Conversations

This chapbook focuses on a Black family of four navigating the recent loss of the matriarch of the family. After the loss, the cracks in their already shaky foundation become more apparent, but all they have left is each other to depend on. The poems in this collection are meant to act as a narrative, and all poems are structured based on the characters who speak, including contrapuntal poems, sonnets, free-form visual poems, and redacted poems. It explores familial themes, grief, and trauma. I asked myself how loss affects mental and physical space, and how the limitation of poetic forms can lead to inventiveness and critical thought regarding the purpose those forms serve.

Honors Project in English
Advisor: Emma Törzs
English Department

Zaryn Prussia

Food and Sovereignty: Enacting Mino-bimaadiziwin in Gaa-waabaabiganikaag

This community-based research dibaajimowin (storytelling) examines the extent to which food insecurity and chronic diseases have become serious problems in my community, Gaa-waabaabiganikaag, the White Earth Reservation. To better understand these problems, think of solutions, and learn how we can create food sovereignty collectively and individually, I worked with staff at the Extension office of the White Earth Tribal and Community College and with local gardeners. Taking a community-based Anishinaabe-centered approach, I listened to stories, conducted interviews, reflected, and dialogued with the land through planting seeds, weeding, ceremony, and helping out at cultural workshops. Based on my experiences in White Earth and literature review, I argue that food insecurity and chronic disease stem from a disruption of Mino-Bimaadiziwin, “well-being” or “good-living”, which as a way of life relies on balanced and reciprocal relationships with all of creation. In this community-based research dibaajimowin (storytelling), we as a community, tell the story of our reservation in relationship to food, well-being, sovereignty, extractivism, and Mino-Bimaadiziwin. We do so to advocate for a resurgence of our traditional foodways in a cooperative and unified way, based on reciprocal, respectful and loving relationships, with the land and all of creation.

Honors Project in Anthropology
Advisor: Olga Gonzalez
Anthropology Department

Amelia G. Renner

Along for the Ride? *Odocoileus Virginianus* as a Potential Driver for *Alliaria Petiolata*

Garlic mustard (*Alliaria petiolata*) is a non-native understory herb native to Eurasia. It is considered invasive and has spread throughout North American forests, notably forming dense monocultures with little to no native plant biodiversity. Previous studies have hypothesized that white-tailed deer (*Odocoileus virginianus*) facilitate garlic mustard expansion; as deer populations grow beyond carrying capacity, selective herbivory and disturbance could allow garlic mustard to infiltrate ecosystems while avoiding direct competition. Deer exclosures were constructed at Katharine Ordway Natural History Study Area in 2018 to investigate how deer removal affects (i) understory community composition, (ii) garlic mustard growth, and (iii) how these effects differ across naturally occurring garlic mustard densities. Exclosures were placed in areas with high or low densities of garlic mustard and paired plots were selected inside and outside of the exclosures. Vegetation surveys were conducted in 2018, 2019, and 2022 to measure understory community response to deer removal across garlic mustard concentrations. Community composition, assessed by principal component analysis, changed significantly over time in exclosure areas; exclosed areas became more different over time, especially in high garlic mustard areas. Canadian wood nettle (*Laportea canadensis*) dominated two exclosures in high garlic mustard areas (>90% coverage) with little cover in the respective paired plots (<4%).

Linear mixed models showed no significant effects of treatment for garlic mustard total cover, rosette cover, stem cover, or the number of stems within plots, although this could be confounded by its biennial phenology. Differences in the species represented in the five tallest plants in each plot were significant in 2020-2022 for high garlic mustard areas and for 2022 in low garlic mustard areas, supporting the hypothesis that treatment effects would be more significant in high garlic mustard areas. Overall, these results indicate that deer have a greater effect on community composition in high garlic mustard areas.

Honors Project in Biology
Advisor: Michael Anderson
Biology Department

Jaylynn Marie Rodriguez

Making the Revolution: The Young Lords and the Creation of a Transnational Puerto Rican Identity

How did the Young Lords contribute to the creation of a collective Puerto Rican identity in the diaspora? Through understanding Puerto Rico (and consequently, Puerto Ricans) as an extension of what Anibal Quijano calls the 'coloniality of power' and building upon Diane Wolf's concept of emotional transnationalism, I dissect the Young Lord's enforcement of a dichotomy between good vs. bad Puerto Ricans, broken down into four archetypes: Revolutionaries, Passive Dissenters, Traitors, Martyrs. This paper highlights the pervasiveness of colonialism as a driving factor in identity formation by centering the unique situation of Puerto Ricans -- what Ramon Grosfoguel calls 'colonial subjects.' Furthermore, it asks us to reflect upon the meanings put behind our identities as we engage in movements of resistance. This research is conducted by examining archived newspapers published by the Young Lords in New York and Chicago in the 1970s. I find that Puerto Rican identity is formulated through a process of culturally and politically distancing oneself from "American" identity. As Puerto Rican identity becomes intertwined with political ideology, a moral typology begins to develop, splitting people into 'good' and 'bad.' As such, good Puerto Ricans are cognizant of the colonial relations between the US and Puerto Rico, and therefore actively center their Puerto Rican identity first. In enforcing this dichotomy through a transnational political movement, where good Puerto Ricans are simultaneously legitimized as true Puerto Ricans, the Young Lords help shape identity within the diaspora. This movement rejects American cultural ideologies, which I define as inherently capitalist, colonial, and individualist, and therefore prioritizes anti-colonial, transnational Puerto Rican identity.

Honors Project in Sociology
Advisor: Erika Busse-Cardenas
Sociology Department

Isabel Luz Elena Saavedra-Weis

***Pachuquismo* and Constructed National Identity in the U.S. and Mexico during the 1940s**

Pachuquismo was a counterculture born in the barrios of East L.A. in the 1940s. Mexican-American youth created their own social group defined by specific clothing (zoot suits), music fusions (mambo and swing), and linguistic dialects (caló). However, on both sides of the U.S. and Mexican border, *pachucos* had a poor reputation. In the U.S., mainstream media portrayed *pachucos* as juvenile delinquents and domestic threats. In Mexico, *pachucos* were mimicked and heavily criticized for their Americanization. In this essay, I identify how U.S. and Mexican mainstream media reacted to *pachucos*, and what those portrayals can tell us about the imagined national identities in both countries. I use Benedict Anderson's concept of "imagined communities" to address the fluidity and subjective nature of defining "American," "Mexican," national or subnational identities. I center my analysis around three main research questions: (1) How did U.S. mainstream media portray *pachucos*, and what can that tell us about the imagined "American" national identity in the 1940s? (2) How did the Mexican film industry portray *pachucos*, and what can that tell us about the imagined "Mexican" national identity in the 1940s? (3) How do *pachucos* portray themselves through their music, and what does this tell us about their self-imagined national identity? To answer these questions, I look at three media sources from the 1940s to analyze the ways *pachucos* were criminalized, rejected, and celebrated: a Disney cartoon, a Mexican comedy movie, and a music album compiled by pachuco musicians from Los Angeles. Taken together, these sources demonstrate that the U.S. and Mexico were creating imagined national identities that were in direct opposition to each other, and excluded *pachucos* for their fusion and hybridity. I argue that contrary to the messages in mainstream media, *pachucos* were not purely rebels without a cause. *Pachucos* had agency: they asserted their belonging and cleared space for future generations of Mexican-Americans.

Honors Project in Spanish

Advisors: Alicia Muñoz

Spanish and Portuguese Department

Margaret Olsen

Spanish and Portuguese Department

Mizuki Samuelson

Mixed Speak: Towards a Re-Poetics of Race and Self

This paper tells the stories of mixed-race Japanese people. I engage in a re-poetics, positing storytelling as an essential tool into complicating our understandings of race and self. I examine the relationship between language and race, exploring how subjects existing within a space of mixedness navigate identity-formation and racial belonging. Operating under a socio-constructivist lens, I begin with a brief re-telling of the history of race in Japan, re-framing mythologies of race throughout literature, legislation, and into national and colonial projects. While popular discourse alleges Japan was and is a country of racial homogeneity, I argue that

this falsifies colonial legacies and denies contemporary realities. I contextualize racial formation in Japan as a convergence of pre-existing language surrounding blood and purity with a racist Western worldview. The second half of this paper transitions towards instances of identity formation. Through a brief linguistic case study, I illustrate the way televisual media reproduces Japaneseness discourse, and the way racialized *hāfu* people must negotiate their identities within its discursive rules, speaking to the embodied tensions of mixedness. Using a combination of interview and autoethnographic material, I center our voices to produce a comprehensive (though not omniscient) view of lived experiences within, through, and between racial lines. Finally, I explore the implications of undoing racial language and consider racial futurities.

Honors Project in Media and Cultural Studies
Advisor: Tia-Simone Gardner
Media and Cultural Studies Department

Margaret Anne Shepherd

SHIELD Galaxies With Offset Neutral Gas Distributions

To investigate galaxy evolution and feedback in dwarf galaxies, we study the 82 galaxies in the Survey of HI in Extremely Low-mass Dwarfs (SHIELD). We analyze radio, optical, and infrared imaging to identify galaxies with an offset between their gaseous and stellar distributions. We classified 11 galaxies as offset and seven as possibly offset. An environmental analysis shows that some of these 18 galaxies are isolated, indicating that feedback may cause the offset. The relative lack of current star formation in these galaxies may indicate recent quenching from feedback.

Honors Project in Physics and Astronomy
Advisor: John Cannon
Physics and Astronomy Department

Andrea Laurine Simmons

Staircase Arrangements of Pillars with Distinct Heights

We study the family \mathcal{A}_n of sequences (a_1, a_2, \dots, a_n) where $0 \leq a_k \leq k$ and nonzero entries are distinct. We show that these sequences are in bijection with the set partitions of $[n + 1]$. These sequences have a natural poset structure, and we analyze the maximal chains within this poset. Finally, we explore various subfamilies of \mathcal{A}_n , including sequences whose largest entry is k and sequences missing the value k .

Honors Project in Mathematics, Statistics and Computer Science
Advisor: Andrew Beveridge
Mathematics, Statistics, and Computer Science Department

Paige K. Stevenson

Collateralizing Ideas: Intangibles in the Credit Market

Intangible capital comprises an increasing share of total capital assets, and its non-physical nature makes it more difficult to evaluate and secure as collateral for loans. I extend the model of intangible capital presented in McGrattan and Prescott (2010) to include a collateralized credit market in which firms can obtain debt proportional to their capital assets. I consider different cases for the relative collateral value of intangibles under a credit constraint subject to exogenous shocks. For greater collateralizability of intangible assets, the model predicts a stronger negative relationship between intangible investment and credit availability and more stable interest rates. However, the model overall does not replicate observations from macroeconomic data.

Honors Project in Economics
Advisor: Mario Solis-Garcia
Economics Department

Sariya Alese Stowers

Do Renewable Portfolio Standards Increase Electricity Prices? Estimating Treatment Effects Beyond States' Own Borders

Renewable Portfolio Standards are a prevalent renewable energy policy in the United States. To meet the requirements of the policy a state's utilities can generate their own electricity, import energy from wholesale connected states, or purchase Renewable Energy Credits. This study focuses on the effect of Renewable Portfolio Standards on retail electricity prices. I use a TWFE and event study specification to estimate the effects of stringency on prices when allowing for electricity trading in the model. I find increases in a state's own standards increase electricity prices in that state and increases in a wholesale connected state's standards decreases electricity prices in the member state. This study highlights the importance of accounting for state electricity trading in renewable energy literature.

Honors Project in Economics
Advisor: Gabriel Lade
Economics Department

Haoxuan Sun

Machine Learning Refinements to Metallicity-Dependent Isotopic Abundance

The project aims to use machine learning algorithms to fit the free parameters of an isotopic scaling model to elemental observations. The processes considered are massive star nucleosynthesis, Type Ia SNe, the s-process, the r-process, and p-isotope production. The analysis on the successful fits seeks to minimize the reduced chi squared between the model and the data. Based on the successful refinement of the isotopic scaling model, a table providing the 287 stable isotopic abundances as a function of metallicity, separated into astrophysical processes, is useful for identifying the chemical history of them. The table provides a complete averaged chemical history for the Galaxy, subject to the underlying model constraints.

Honors Project in Physics and Astronomy
Advisor: Christopher West
Physics and Astronomy Department

Anna Šverclová

Zastrugi: Poems

Zastrugi is a collection of poems that explores my complex relationship with my schizophrenic mother, my own struggles with my mental health, and the systems for mental health treatment in the United States that affect our relationship. In this project, I examine the social origins of my fear of my mother against a backdrop of secondary historical sources related to psychology and psychiatric treatment in the 19th and 20th centuries (Andrew Scull, Esmé Weijun Wang, and Lisa Appignanesi), in a style of poetics informed and influenced by a variety of contemporary poets in conversation about disability, trauma, and grief (Sharon Olds, Sylvia Plath, Anne Sexton, Leila Chatti, Cameron Awkward-Rich, Jenny Boychuk, Donika Kelly, Devon Walker-Figueroa, and Diane Seuss). Engaging with a wide range of forms and styles, from prose poetry to shorter lyrics, I reflect upon the impact that my mother's illness, absence, and institutionalization have had on my life and sense of self, as well as the ways in which my feelings about our relationship are impacted by ableist social constructions of severe mental illness.

Honors Project in English
Advisor: Michael Prior
English Department

Karlee Regina Taylor

Constraining the Timing and Mechanism of Uplift of the Condrey Mountain Dome in the Klamath Mountains Province Using Apatite (U-Th)/He Thermochronology

The Condrey Mountain Schist lies at the center of an anomalous, young, domal structure in the midst of the Klamath Mountains in Southern Oregon-Northern California. This effort aims to constrain the timing and mechanism of the uplift of this structure, using (U-Th)/He thermochronology on zircon and apatite grains from surrounding plutons. Grain ages and thermal modeling suggest that uplift was the result of two cooling episodes – firstly, Early Cretaceous uplift due to subduction and accretion at the Pacific-North American plate boundary; followed by Miocene uplift as a result of the northwestern movement of the Sierra Nevada block.

Honors Project in Geology
Advisor: Alan Chapman
Geology Department

Kevin A. Tovar

Characterizing Methylisothiazolinone (MI) Mediated Changes in the Immune Activities of Murine Labial Skin Fibroblasts

Vulvodynia is a chronic vulvar pain condition of unknown etiology estimated to affect 10-28% of individuals with vulvas. It is defined by increased sensitivity to touch in the vulvar region and accompanied by increased mast cell density, and hyperinnervation in the tissue. While etiology is unknown, an increased risk is associated with a history of allergies, recurrent vulvovaginal yeast infections, and exposure to cleaning agents, solvents, and paints. Incidence of allergies to a common chemical preservative used in these products methylisothiazolinone (MI) has been on the rise. To interrogate the mechanism of chronic pain development we use a murine model of MI-driven chronic vulvar pain that recapitulates clinical findings of vulvodynia. We are characterizing MI mediated inflammatory changes in the local tissue environment, particularly labial fibroblasts, as these cells from patients have been shown to exhibit heightened cytokine production in response to pathogenic challenge. Labial fibroblasts derived one day after ten exposures to MI to mouse labia show a trend of increased proinflammatory cytokines IL-6 and TNF- α production in response to activation. This increased cytokine signaling profile is seen up to ninety-one days after last exposure to MI, suggesting a long-lasting change in fibroblast cytokine production potential. Moreover, we observed labial fibroblasts derived one day after one exposure to MI show increased IL-6 production, indicating changes in labial fibroblasts are occurring early on. We are further characterizing these changes and investigating the interactions between fibroblasts and other immune cells, particularly mast cells, to elucidate potential mechanisms underlying the intersection of allergies and chronic pain. Additionally, we are investigating the cytotoxic effects of MI on fibroblasts and its effect on cytokine signaling.

Honors Project in Biology
Advisor: Elena Tonc
Biology Department

Mỹ Linh (Lucy) Trần

Music On Canvas: A Quest to Generate Art That Evokes the Feeling of Music

Although the idea of connecting music and art dates back to ancient Greece, recent advancements in computing have made automating this feasible. This project represents a quest to transform music into art, using three methodologies where each is an improvement towards generating images that convey our feelings and imaginations during music listening. The three methods respectively involve (1) an element-wise mapping of sound and colors, (2) using song tags, and (3) tuning an Artificial Intelligence (AI) model to generate pictorial text captions. To create artistic images, methods two and three utilize an existing text-to-image generative AI.

Honors Project in Mathematics, Statistics and Computer Science
Advisor: Libby Shoop
Mathematics, Statistics, and Computer Science Department

Henry J. Tyson

Made to Carry

My honors project consists of a series of hand-built and wheel-thrown ceramic sculptures that investigate the functions, associations, and assumptions of the body, pottery, and the points at which they overlap. This project posits queer intimacy as a counter to traditional views of sex, gender, and tenderness. Is it not a basic function of the body to hold another? To love? The collection of seven earthenware and raku clay sculptures employ traditional naturalistic representation, ancient Athenian vessels, abstract human forms, and their intersections. The works are my questions — by blending the human form with functional pottery, I ask: if we are indeed vessels, may we choose what we were made to carry? What does my body hold and why?

Honors Project in Studio Art
Advisor: Summer Hills-Bonczyk
Art and Art History Department

Andie Elizabeth Walker

Not So Set in Stone: A Digital History of the Macalester College Campus

College communities are constantly in flux, as students typically remain in school for only four years. However, parts of the physical environment of a college campus might last for centuries. This project investigates the evolution of Macalester College’s campus and asks the following questions: What has guided the design decisions for new buildings and structures at Macalester throughout its history? How have people interacted with, manipulated, and potentially subverted these spaces and places? How is settler colonialism physically embodied at Macalester? These questions have illuminated the ways that people have attempted to control the space and place that makes up Macalester, and how people have resisted or subverted that control. I have compiled my research into a digital exhibit in order to communicate how architecture and design has served as a tool to convey Macalester’s values and to shape the experiences of students as they eat, sleep, study, and socialize on campus.

Honors Project for Individually Designed Interdepartmental Major in Digital History
Communication

Advisor: Jessica Pearson
History Department

Ronan Liam Wallace

Utilizing Remote Sensing Technology to Relocate Lubra Village and Visualize Flood Damages

As weather patterns change worldwide, isolated communities impacted by climate change go unnoticed and we need community and habitat-conscious solutions. In Himalayan Nepal, indigenous Lubra village faces increasing flash flooding. After every flood, sediment encroaches on Lubra’s agricultural fields and homes, magnifying flood vulnerability. To investigate further, we utilize remote sensing to create highly detailed 3D visualizations to document climate-related impacts in Lubra village. In tandem, we conduct Tibetan oral interviews in Lubra to culturally contextualize these models. Pairing visualized data with personal accounts, we provide an informative story depicting Himalayan climate change on a local level through Lubra’s voice.

Honors Project in Mathematics, Statistics and Computer Science

Advisor: Susan Fox
Mathematics, Statistics and Computer Science Department

Maximilian Chan Weiher

A Friend Who Does Me No Good: Aphorism in Matteo Ricci's *On Friendship*

This paper argues that Italian Jesuit Matteo Ricci (1552 - 1610) designed his aphoristic compilation, *Jiaoyou Lun* 交友論—*On Friendship* (1595)—to serve the Jesuit mission of converting the Chinese to Catholicism and express the conflict he may have felt exploiting friends to forward the Jesuit mission. Utilizing friendships to allow for greater social influence was central to the Jesuit proselytization strategy in China. However, Ricci's moral education from youth taught him to judge utilitarian friendships as immoral. The extant scholarship regarding Ricci's *On Friendship* fails to acknowledge the significance of the aphoristic form to this work. To illuminate the value of aphorism to the Jesuit mission and this book, I analyze a selection of the book's one-hundred maxims. My interpretation emphasizes the tone of authority and universality established through the genre's concision. This brevity can raise questions about the meaning of the text and spark conversations, strengthening friendships among readers, and arguably furthering the goals of the mission. Additionally, the text's inconsistent moral portrayal of utilitarian friendship may reveal Ricci's ambivalence about his own friendships with Chinese literati. Through close reading of *On Friendship*, I posit that the aphorism's brevity and ambiguity may have allowed Ricci to express his emotional unrest while still crafting a book that could be considered a tool of proselytization.

Honors Project in Asian Languages and Cultures
Advisor: Rivi Handler-Spitz
Asian Languages and Cultures Department

Amber Wiedenhoef

Relationship of *Nothofagus Pumilio* Dendrochronology to Precipitation in Patagonia, Chile

Tree ring width in any given year depends on tree species and age, as well as environmental conditions such as temperature, precipitation, and even wildfire occurrence. Because of the dependence of overall tree health and growth rates on climate, variability in tree ring width and diameter is used to infer past climate variations. This study compares precipitation data obtained from Chile's Centro de Ciencias del Clima y la Resiliencia (CR²) and Diameter at Breast Height (DBH) to average tree ring growth per year of *Nothofagus pumilio* in Puerto Natales, Chile. My results demonstrate there is an overall positive linear trend of the averaged tree-ring widths over the last century, but there is not a significant correlation between total annual precipitation or DBH and tree-ring width.

Honors Project in Geology
Advisor: Kelly MacGregor
Geology Department

Yosan Worota

Thymic B Cells Uniquely Shape Regulatory T cell Selection

Thymic B cells are a subpopulation of B lymphocytes that reside in the thymic medulla, an organ that is specialized for the development and selection of T lymphocytes. Thymic B cells are activated by CD40L+ CD4 single positive thymocytes, leading to upregulation of MHC-II, costimulatory molecules CD80 and CD86, initiation of immunoglobulin class switch recombination (CSR), resulting in the licensing of thymic B cells as professional antigen-presenting cells (APCs). The thymus also harbors other APC populations such as dendritic cells and medullary thymic epithelial cells (mTECs) that use unique strategies of self-antigen expression and presentation to mediate central tolerance. Whether thymic B cells confer unique tolerogenic features on developing thymocytes is not fully understood. From T cell receptor (TCR) repertoire deep sequencing, we identified CD4 single positive thymocytes that were dependent on licensed thymic B cells for development. Furthermore, testing these TCRs using intrathymic transfers, generation of retrogenic mice and hybridoma cells lines demonstrated licensed B cells may be critical for the optimal development of a substantial fraction of the Foxp3+ regulatory T (Treg) cell repertoire and likely play an essential tolerogenic role in the generation of a healthy Treg cell repertoire.

Honors Project in Biology

Advisors: Elena Tonc

Biology Department

Ryan Martinez

Laboratory Medicine and Pathology, University of Minnesota

Austin Siping Wu

Battle on the Brahmaputra: A Neoclassical Realist Analysis of the Sino-Indian Water War

As global water supplies are stressed by climate change and a rising population, water's potency as a vector for interstate competition has also increased. Perhaps no states exemplify this trend better than India and China, and the Brahmaputra, which runs between them, sits at the heart of an ongoing conversation about future "water wars." Using a lens of Neoclassical Realism, this paper attempts to understand the likelihood of a water war (a war fought primarily over control of hydrological resources) is likely to break out over the Brahmaputra. The findings suggest that the probability of war in the status quo is low, due to China's status as the upper riparian power and its superior military, economic and institutional strength. However, three

troubling salient trends are also identified - rising water demand, increasing nationalist fervor, and a closing Sino-Indian power gap. All three of these factors will greatly increase the future risk of conflict.

Honors Project in Political Science
Advisor: Andrew Latham
Political Science Department

Ganghe Xu

Mixing Times for Random Walks on Lattice Paths

A random walk on a connected graph is a probabilistic process where each node has some probability to transition to one of its neighbors. It is known that on an aperiodic, irreducible, and symmetric random walk, there is a uniform limiting distribution for the likelihood of locations after some period of time. The mixing time is the number of steps it takes so that the distribution is reasonably close to the limiting distribution. This means on any state space, we can design a random walk satisfying the above properties, and perform random walk to get a random sample. In this honors thesis, we define and discuss two random walks with state spaces in Schröder paths, and present an argument using canonical paths that will bound the mixing time of one of the chains. We also explore a technique called Coupling From the Past, and provide empirical evidence of the mixing time of the other chain, which has proved less amenable to the Canonical path argument.

Honors Project in Mathematics, Statistics and Computer Science
Advisor: Andrew Beveridge
Mathematics, Statistics, and Computer Science Department

Ziyue (Grace) Xue

“Watchdog” or “Lapdog?” Comparative Study on Chinese Investigative Journalism in SARS and COVID-19 Pandemic

This study examines the decline of investigative journalism in China by comparing reporting about the SARS pandemic in 2003 and the COVID-19 pandemic in 2020. It employs interviews with Chinese journalists and critical discourse analysis of Chinese news coverage by *Caijing*, *Caixin*, and *Southern Metropolis Daily* to explore how news genre and framing have changed through time and what political and social factors are influencing those changes. By studying the challenges that investigative journalists face, this study hopes to shine a light on what can be done in the future to revitalize Chinese investigative journalism.

Honors Project in Media and Cultural Studies
Advisor: Tia-Simone Gardner
Media and Cultural Studies Department

Dheera S. Yalamanchili

Addressing Environmental Inequality Beliefs: The Role of a Global Identity

Climate change is one of the greatest existential challenges facing humanity today, with existing global inequalities expected only to be exacerbated by worsening weather and climate impacts; thus, ascertaining pathways to increase human knowledge, care, and desire to address and support solutions tackling environmental inequality is paramount. Previous research has identified the concept of a global identity and suggests that it may play a role in reducing inaction surrounding climate change and justice (Reese, 2015). Other research has found significant relationships between global identity and various pro-environmental and pro-social factors (e.g., Assis et al., 2017; Joanes, 2019). However, no previous research has explored a correlation between global identity and environmental justice. Study 1 served to fill this gap in the literature and found that there was a positive correlation between global identity and support for environmental justice policy, as well as the accuracy of environmental inequality beliefs. To extend this finding, Study 2 experimentally examined whether the situational salience of global identity could be manipulated through stimulus conditions and if this, in turn, correlated with greater environmental justice beliefs. As results showed no significant differences between participants in the control vs. stimulus groups, future research could benefit from investigating the influence of stimuli on a situational scale for global identity. Combined study findings

indicate that individuals with greater global identification are more likely to have more accurate beliefs regarding environmental inequality and even greater support for policy addressing it—which can, importantly, inform the design of future interventions aimed at improving human behavior change regarding environmental inequality.

Honors Project in Environmental Studies
Advisor: Christie Manning
Environmental Studies Department

Yuki Yokoi

The Gaze and the Other on Social Media: Reexamining Existence as Human Beings in the Digital Age

Social media is now a prevailing tool for people and we often interact with other people on social media. Human interaction takes place both in face-to-face settings and on social media and becoming so-called influencers is a dream among teenagers. However, using social media necessarily entails exposure to the other people and social media companies. Then, is using social media existentially beneficial? I explore this question by employing arguments from Erving Goffman, Jean-Paul Sartre, and Guy Debord to explicate the existential issues which social media entails. From Sartre and Debord’s perspectives, we are inevitably objectified by the gaze when using social media but we might use social media as a means to achieve our goals. Then, I argue that social media would be a valuable tool for us to achieve our own goals but we are inevitably objectified and easily feel existential anxiety in our everyday life.

Honors Project in Philosophy
Advisor: Diane Michelfelder
Philosophy Department

Yixuan Zhang

Unravelling the Mystery of Chronic Kidney Disease of Unknown Cause

Chronic Kidney disease of unknown cause (CKDu) is a leading cause of premature death in Nicaragua, primarily affecting young men in rural communities. Patients often suffer from acute kidney failure with no known cause, leaving the doctors clueless about prevention and treatment. Researchers have identified associations with CKDu, including exposure to agrichemicals, infectious diseases, and working in sugarcane fields.

Using prospective longitudinal cohort data from Nicaragua, I estimated a multivariate three-state Hidden Markov model and a Markov model to examine the potential time-varying

environmental, occupational, and lifestyle exposures that could impact kidney health and transition from healthy to unhealthy. The states in the Markov models reflect kidney health states: healthy, borderline, and unhealthy. However, since the state of kidney health is unknown, we can model the distribution of the eGFR (estimated glomerular filtration rate), a measure of kidney function, and its annual rate of change. Multiple imputation is employed to impute the eGFR rate of change at baseline to estimate the state of kidney health at the start of the study. In addition to the data analysis, I ran a simulation study to analyze computation issues of the Hidden Markov model from the msm package.

The Hidden Markov model suggests that smoking regularly and sugarcane work maintain borderline kidney health. Drinking alcohol regularly both maintains and initiates transition to borderline and unhealthy kidney health. The Markov model also identified smoking regularly, sugarcane work, and drinking alcohol regularly as significant exposures that initiate the transition to an unhealthy kidney state. The simulation study shows that rare exposures are responsible for some convergence issues even with larger sample size and longer study duration.

Women are less likely to be impacted by CKDu, but social and cultural factors make it challenging to disentangle associations with sex from other environmental and occupational exposures. Future research is needed to further whether these exposures are proxies to the true underlying causes. Explaining the initiation of CKDu has great public health impacts. It can lead to developing prevention strategies and treatments, improving the understanding and awareness of this epidemic.

Honors Project in Mathematics, Statistics and Computer Science

Advisor: Brianna Heggeseth

Mathematics, Statistics, and Computer Science Department

Zichen Zhang

Visuomotor Attention Model for General Robot Manipulation with Multimodal Prompts

Large transformers have successfully consolidated diverse tasks by means of prompting, which provides a flexible interface to communicate natural language tasks to a general-purpose model. However, textual instruction alone may not be sufficient or convenient to specify robot manipulation tasks. In many applications, alternative formats like visual goals, few-shot image concepts, and video skill demonstrations have much more expressive power, yet they often require different policy architectures, objective functions, data preprocessing, and training procedures in prior works. We propose a multimodal prompting framework that casts any robot manipulation command to the same sequence format of interleaving text tokens and visual frames. Thanks to this uniform IO interface, we design a novel transformer-based robot learning architecture, VIMA, that ingests the multimodal task prompts and outputs control commands for a robot arm autoregressively. To systematically evaluate \vima, we introduce a novel benchmark simulation suite with 17 procedurally-generated tabletop tasks with multimodal prompt templates, 4 levels of generalization protocol, and 600K+ training trajectories. VIMA achieves strong scalability in both model capacity and data size. It outperforms prior SOTA methods in the hardest zero-shot generalization setting by up to 2.9x task success rate given the same

training data. With 10x less training data, VIMA still performs 2.7x better than the top competing approach.

Honors Project in Mathematics, Statistics, and Computer Science
Advisor: Susan Fox
Mathematics, Statistics and Computer Science Department

Chloe Zheng

Development of a Particle-in-Cell/Monte Carlo Simulation for Weakly Ionized Plasmas

A plasma is a gaseous system that contains large numbers of electrons and ions that are subject to forces produced by electric and magnetic fields. Weakly ionized plasmas, where the plasma density is much lower than the background gas density, are common in laboratory, atmospheric, and astrophysical situations. Theoretical calculations of plasma properties are challenging due to the complexity of the differential equations used to characterize the fundamental physics. Particle-in-cell (PIC) simulations bypass the mathematical difficulties associated with analytic models, at the expense of more complex and time-consuming computer calculations. In this work I developed a one dimensional PIC simulation of a weakly ionized plasma. I use a Monte Carlo technique to include a simplified model of electron-gas and ion-gas collisions. The results of preliminary simulations give good qualitative agreement with simplified theoretical models of plasma sheath formation and ambipolar diffusion.

Honors Project in Physics and Astronomy
Advisor: James Doyle
Physics and Astronomy Department

Yike Zhou

The Effect of the China Shock on the 2016 and 2020 Presidential Elections

Trade liberalization in 2000 opened up the door for increased trade between China and the US, favoring Chinese manufacturers. This period is often referred to as the "China shock" (Autor, 2013). This paper utilizes data collected from the MIT election lab, FRED, and David Dorn's published data to investigate the effect of the China import shock in the early 2000s on the most recent two US presidential elections. Our analysis, which employs commuting zone-level data, reveals that regions more adversely affected by the China shock were more likely to vote for the Republican Party, while regions that suffered less harm were more likely to vote for the Democratic Party. This research sheds light on the future trade and domestic policies aimed at protecting against economic downturns due to international trade. For instance, policymakers

should consider the establishment of assistance and support programs for workers displaced by trade liberalization, such as the Trade Adjustment Assistance (TAA) Program, Unemployment Insurance (UI), and other retraining and compensation policies (Autor et al., 2021). Such policies may influence voters' choices in future elections.

Honors Project in Economics
Advisor: Gary Krueger
Economics Department

Temazulu S. Zulu

SARS-CoV-2 Quantum Sensor Using NV Centers in Nanodiamonds

The application of quantum mechanics in quantum sensing has grown exponentially in the past decade. Nitrogen Vacancy (NV) centers in nanodiamonds have emerged as a leading quantum sensing platform due to their room temperature coherence and functionality in engineering applications. In this work, with the Quantum Engineering Group at MIT, we propose the use of NV centers for biosensing to detect the presence of SARS-CoV-2 virus. A green laser excites the NV spins and when they decay to their ground state they emit red fluorescence, providing a mechanism for optical characterization. We can attach magnetic ions (Gadolinium complexes) to the nanodiamonds that can bind to SARS-CoV-2 viral RNA. The binding then causes these complexes to detach from the nanodiamond due to the stronger magnetic spins produced. The detachment is revealed by longer fluorescence longitudinal relaxation times which we can measure. This work describes the first stage of this development project: we begin by characterizing the relaxation times of pure nanodiamonds before attaching Gadolinium complexes and viral RNA on the nanodiamond surfaces. In order to comprehend this process from abstract quantum mechanics to applied physics, we also formulate a basis for how quantum sensing works, and why NV centers work as biosensors. This will help to provide a concrete case for the viability of NV centers in quantum sensing and in the proposed application.

Honors Project in Physics and Astronomy
Advisor: James Heyman
Physics and Astronomy Department
