UNDERGRADUATE STUDENT RESEARCH AND INTERNSHIP SYMPOSIUM

WEITZ CENTER FOR CREATIVITY COMMONS
4:30 - 6:00 PM
OCTOBER 15, 2021

www.carleton.edu/research/symposium/2021-symposium/

October 15, 2021

Welcome to the 2021 Student Research and Internship Symposium at Carleton.

Today we honor the many students who have explored career paths and engaged in advanced work in their respective fields, building on the knowledge and skills they acquired throughout their work at Carleton and beyond. [We are especially pleased to celebrate this event in person, after so many of our community members experienced challenges beyond our comprehension since the arrival of COVID.]

Experiential learning via research, internships, and fellowships are at the heart of a Carleton education. Through their posters and oral presentations these students reveal the habits of mind that an outstanding liberal arts education provides – curiosity, adaptability, careful observation, reflection, and compelling communication. We are proud of their many accomplishments.

We also wish to acknowledge and celebrate the great diversity of experiences represented here. Staff and faculty from many different departments and programs have supervised student research and internship projects, and community members have helped students to grapple with how their knowledge, skills, and values play out in the complexity of the real-world. Taken together, the work of these students attests to the breadth of experiential learning opportunities afforded by Carleton and the many ways in which faculty and staff throughout the College inspire and support student scholarship and plant the seeds for life-long learning.

Finally, we call attention to the many significant mentoring relationships that fostered this work and were deepened as a result of it. As generations of Carleton students will attest, the opportunity to work closely with faculty and staff is among the most impactful and memorable of their experiences here. Behind each of these presentations is a faculty, staff, or community member whose guidance, encouragement and coaching enriched the education of students and inspired them to go further than they imagined they could. We are grateful for the dedication and attentiveness of all these mentors.

We invite you to engage with these students, to question them about their work and its significance to them and the world. In this way, we hope you will join them, at least briefly, on the journey they have undertaken.

Thank you for joining us for this symposium and celebration.

Gretchen Hofmeister, Dean of the College

Carolyn H. Livingston, Vice President for Student Life and Dean of Students

1. Awurama Akyianu

Class Year: 2022
Major(s): Chemistry
Supervisor(s) and affiliation or institution: Steven Millward, Brian Grindel (MD Anderson)

Title: *An enolase inhibitor for the targeted treatment of ENO1-deleted cancers*
Inhibiting glycolysis and other metabolic pathways in cancer is challenging due to the heightened toxicity of normal cells. Collateral lethality therapies capitalize on the "cancer-specific metabolic vulnerabilities'' arising from the deletion of genes neighboring tumor suppressors. A prime example is the homozygous deletion of the 1p36 tumor suppressor locus resulting in the concomitant deletion of the glycolytic enzyme gene, ENO1 (encoding enolase 1), in cancers like glioblastoma. The two enolase paralogs, ENO1 and ENO2, are essential in the glycolytic pathway given its role in the catalytic conversion of 2-phosphoglycerate (2 PG) to phosphoenolpyruvate. Cells lacking ENO1 are especially sensitive to inhibition of ENO2 and using this premise treatments were developed. One such treatment involves a phosphonate-containing ENO2 inhibitor. Dubbed HEX, this drug shows higher specificity for ENO2 over ENO1. Since HEX bears a resemblance structurally to the 2 PG, it inhibits ENO2 competitively. But, with HEX being anionic in nature, a cell-permeable version, POMHEX, was also developed. In this work, the inhibitory concentration (IC50) of HEX was determined on glioblastoma cells with different ENO1 deletions and combined with a standard-of-care glioblastoma drug, temozolomide (TMZ), to assess any synergistic effects.

https://openworks.mdanderson.org

2. Ariel Alexander

Class Year: 2024
Major(s): Undeclared

Title: *Summer Public Policy Internship with Laura Baker Services Association*
Laura Baker Services Association (LBSA) is a non-profit intellectual and developmental disabilities services provider located in Northfield, MN. LBSA offers services to provide holistic support to people with intellectual and developmental disabilities, including: residential living options, family support services, creative arts and music programming.

This summer, I served as the Public Policy intern for LBSA and focused on advocacy, community/volunteer outreach, marketing, public policy work. Throughout the summer I worked on creating messaging, flyers, and infographics to visually present information related to LBSA. Additionally, I created and managed a volunteer hub to increase communication efficiency between LBSA and volunteers. I am incredibly grateful to LBSA for allowing me to work with them this summer, as I broadened my knowledge surrounding disability services providers while assisting in the process.

This experience was funded by: Multicultural Alumni Network Fellowship Program (MCAN)

3. Evan Arch

Class Year: 2024
Major(s): Undecided
Other Authors/Contributors: Elise Knutsen, Kevin Clelland, Logan Plasch
Supervisor(s) and affiliation or institution: Barry Costanzi (Assistant Professor of Physics, Carleton College)

Title: *Magnetic Configurations of Mesoscale Permalloy Dots*
The magnetic behavior of electrons can be clearly modeled at extreme length scales. However, at sizes in the hundreds of nanometers, the mesoscale, the behavior is difficult to predict due to the interaction of the classical magnetostatic forces and the quantum exchange forces. To better understand the interaction of these forces at the mesoscale, we characterize the magnetization of 175-250 nm square Permalloy ($Ni_{80}Fe_{20}$) dots. Understanding magnetization at this size is critical for the future development of spintronic devices.

This experience was funded by: Ford Fund

4. Aryan Arora

Class Year: 2024
Major(s): Undecided

Title: *Community Organizing with the IAF*
This summer I had the opportunity to work as a community organizer in Maryland. I worked with groups ranging from section 8 tenants to farmers and through it all developed a nuanced understanding of power—how we develop it and how we use it.

This experience was funded by: John '55 and Bonnie Raines Endowed Internship Fund

5. Dan Ashurst

Class Year: 2022
Major(s): Art History

Title: *Grateful Gatherings: Sharing Stories of Hope*
Grateful Gatherings is a San Francisco-based non-profit that furnishes the homes of families that were recently houseless. By collecting furniture, organizing volunteers, and working with community partners, Grateful Gatherings draws on the good will of the Bay Area to help others. As Grateful Gatherings' Social Media Specialist, I managed their social media presence on Facebook, LinkedIn, and Instagram. The posts I created shared the stories of families that they helped, raised money so that they could help more, and grew Grateful Gatherings' community reach.

This experience was funded by: Sam '75 and Meg Woodside Fund for Career Exploration

6. Avi Bailon

Class Year: 2023
Major(s): Environmental Studies

Title: *Immigration Law at the James H. Binger Center for New Americans at the University of Minnesota*
This summer I worked with the Immigration Law Clinic at the UMN. The James H. Binger Center for New Americans provided me the opportunity to work alongside my supervisor, the Detainee Rights Clinic Director that defends the rights of indigent noncitizens incarcerated by the Department of Homeland Security, learn about immigration law firsthand. My day-to-day consisted of researching case information, contacting clients, and court observation data.

This experience was funded by: Social Justice Internships funds from the Chaplain's office

7. Grace Bassekle

Class Year: 2024
Major(s): Undecided

Title: *Affordable Housing with Beacon Interfaith*
Throughout my internship I advocated for affordable housing in the twin cities governmental sectors and the non-profit arena. I facilitated meetings with congregational members and organizers, and participated in One-on-Ones with congregational members.

This experience was funded by: Alsdorf Internship Fund

8. Ruken Bastimar

Class Year: 2022
Major(s): Cognitive Science, Music
Other Authors/Contributors: Isabella Vazquez
Supervisor(s) and affiliation or institution: Kathleen M. Galotti (William H. Laird Professor of Cognitive Science, Carleton College)

Title: *Assessing Ways of Knowing and Preferences for Online vs. In-Person Learning*
The rapid spread of COVID-19 necessitated worldwide distance learning. Previous research had identified gender-based differences in the way students performed depending on the mode of instruction. Another branch of research has also identified two ways of knowing (WOK), towards which male and female undergraduate students had a different proclivity: females relying heavily on connected knowing (CK), which emphasizes empathy, collaboration, and withholding judgment, and males using separate knowing (SK), which includes detachment from emotions, critical reasoning, and argumentation. This study recruited 213 undergraduates and used two instruments to assess WOK and preferences for mode of instruction in order to determine whether gender-based differences in WOK could predict preferences for online and in-person learning. The results, although showing clear gender differences for WOK, showed no significant correlations between WOK and preference for mode of learning, indicating that WOK may not be accurate predictors of student preferences for online or in-person learning.

This experience was funded by: Towsley Endowment

9. Ruken Bastimar

Class Year: 2022
Major(s): Cognitive Science, Music
Other Authors/Contributors: Isabella Vazquez
Supervisor(s) and affiliation or institution: Kathleen M. Galotti (William H. Laird Professor of Cognitive Science, Carleton College)

Title: *The Academic Experiences Survey (AES): Assessing Undergraduate Perception of the Liberal Arts Experience*
This study is a continuation of a 2016 study that developed and tested the Academic Experiences Survey (AES)—a 45-item, 5-scale survey that focuses on students' overall attitudes towards learning in a liberal arts context. Different from conventional collegiate assessment measures, the 2016 study was designed to gain insight into student perception of knowledge itself and understanding of liberal arts education goals. Data were collected from first-year undergraduates throughout the year to analyze their epistemological development. Expanding on the 2016 study, this study collected student responses to the AES over their four years at Carleton College. One hundred and eighty-two students participated in

one or more sessions during the fall of 2015-2018. Results indicate that, changes in interdisciplinary understanding, skills, comfort level, and liberal arts understanding tended to be more pronounced between freshman year and other years, suggesting that freshman year is a particularly significant time for liberal arts students.

10. Nate Bauer

Class Year: 2024
Major(s): Undecided

Title: *Intern for State Representative Todd Lippert (D-20B)*
This summer I worked as an intern for Minnesota State Representative Todd Lippert. Representative Lippert represents District 20B, which comprises Northfield and the surrounding area (including Lonsdale, Montgomery and Dundas, amongst other towns). He is a member of the Democratic-Farmer-Labor Party, the Minnesota state chapter of the national Democratic party. In my capacity as campaign intern, I had many duties: coordinating meetings with various people and organizations in the Minnesota political landscape, assisting with social media content, engaging with persuadable voters during canvassing sessions, and more.

11. Alison Block

Class Year: 2022
Major(s): Chemistry

Title: *Room-Temperature Fabrication of Dielectric Ceramics*
Conventional ceramic processing techniques use high-temperature sintering to achieve high degrees of densification in ceramic compacts; however, this process uses a significant amount of energy. Room-temperature fabrication (RTF) of ceramic materials presents a promising energy-efficient alternative, which effectively eliminates the need to use a furnace. It also allows for cofiring of materials with lower sintering temperatures; however, the multiphase composition and hygroscopic nature of pellets produced using this method make fabricating functional ceramics a challenge. Our goal is to fabricate capacitors with properties comparable to those produced via conventional techniques. Composite pellets composed of the dielectric $PbZr_xTi_{1-x}O_3$ (PZT) and $Ba_{1-x}Sr_xTiO_3$ (BST) perovskite ceramics and Li_2MoO_4 binder will be synthesized via RTF. The volume fraction of binder material and ceramic particle size distribution and composition will be varied to minimize porosity and optimize relative permittivity, which will be measured using an LCR meter at temperatures ranging from $-60 – 150°C$.

12. Malachy Bloom

Class Year: 2024
Major(s): Undecided
Other Authors/Contributors: Michael Yang
Supervisor(s) and affiliation or institution: Jay Tasson (Associate Professor of Physics, Carleton College)

Title: *Dispersion Analysis of Gravitational Waves*
General relativity (GR) predicts that gravitational waves (GWs) travel through spacetime at the speed of light, independent of their direction of travel and frequency. The Laser Inteferometer Gravitational-Wave Observatory (LIGO) detects GWs passing through Earth. With these detections, we test for

gravitational Lorentz invariance violation (gLIV). Tests for gLIV are part of a greater effort to unify the Standard Model and GR. To this end, we constrain 16 k coefficients by randomly drawing from the samples of 24 events. The results we obtain show no significant sign of gLIV.

13. Vicente Bobadilla Riquelme

Class Year: 2022
Major(s): Computer Science
Supervisor(s) and affiliation or institution: Seshan Srinivasan (Professor of Computer Science, Carnegie Mellon University), Devdeep Ray (Carnegie Mellon University)

Title: *Network Loss Prediction for Low Latency Video Steaming*
Low latency video streaming applications like AR/VR streaming and cloud streaming for video games have recently gained traction. Cloud streaming applications demand very low latency and uninterrupted video playback, which is a significant challenge in the face of packet loss that can happen due to various reasons like network congestion and wireless losses. A key challenge with handling packet loss is that there can be a large delay between the sending of a packet and detecting that the packet was lost. We have developed a streaming system that can significantly benefit from early packet loss predictions like ""there is a 50% chance of a packet drop in the next 3 RTTs"". The goal of this research project is to conduct a measurement study or use available data to design an ML/AI based packet loss prediction mechanism that can run in real-time and provide early packet loss forecasts to ensure smooth video playback in the presence of packet loss.

14. Sally Boerma

Class Year: 2023
Major(s): Biology
Supervisor(s) and affiliation or institution: Greg Matera (Professor of Biology, The University of North Carolina at Chapel Hill), Harmony Salzler (Associate Research Scientist, The University of North Carolina at Chapel Hill)

Title: *Investigating the Function of Histone 3 Lysine 36 in X-Chromosome Dosage Compensation*
Many human diseases are thought to be caused by the misregulation of histone post-translational modifications (PTMs). We investigated the Histone 3 lysine 36 (H3K36) PTM and its suspected role in X-chromosome dosage compensation in Drosophila melanogaster. The male-specific lethal (MSL) complex, which regulates dosage compensation, both acetylates Histone 4 lysine 16 (H4K16) to promote transcriptional activity and putatively binds at H3K36 sites. Therefore, we hypothesized that if the MSL complex is unable to bind to H3K36, it would be unable to acetylate H4K16, rendering dosage compensation defective. We generated flies that contain mutated H3K36 genes and found that these mutants hatch at a significantly lower rate than H3K36 wild-type flies. We also determined that approximately 50 percent of mutant first instar larvae were males and that the mutants do not see a reduction of H4K16ac. These results indicate that dosage compensation is not the cause of reduced embryonic mutant viability.

15. Maddie Boulis

Class Year: 2023
Major(s): Biology
Supervisor(s) and affiliation or institution: Rika Anderson (Assistant Professor of Biology, Carleton College)

Title: *Quantifying the Microbiome of the Lost City Vent Field*
The Lost City hydrothermal vent field located in the mid-Atlantic hosts unique hydrothermal vents driven by serpentization, a high-temperature reaction between olivine and water. This project quantified the number of virus-like particles collected from the Lost City hydrothermal vent field in an exploratory attempt to examine the vents' microbiome and to understand how Lost City and other similar vents influence the evolution of cells and viruses in their unique chemical environment. Viruses and cells in seawater samples taken from the vent field were stained with SYBR, a fluorescent dye that binds to dsDNA and counted using a high-powered epifluorescent microscope. Results showed no noticeable difference between virus and cell quantities between the vent and plume samples. These findings establish a preliminary understanding of the Lost City microbiome and suggest that more research is needed to understand Lost City's effects on cells and viruses in the vents.

16. Ben Brewster

Class Year: 2022
Major(s): Chemistry
Supervisor(s) and affiliation or institution: Matt Whited (Associate Professor of Chemistry, Carleton College)

Title: *Probing C–H Activation by Rhodium Silyl Pincer-Type Complexes*
C–H functionalization is a valuable tool in organic synthesis, but most metal-catalyzed approaches to imparting regioselectivity rely on the metal serving dual roles of coordinating a basic functional group and performing C–H activation. However, recent reports demonstrated that iridium boron pincer-type complexes facilitate C–H activation and functionalization by coordination of substrates to boron prior to C–H cleavage at iridium, imparting distinct selectivity. This project attempts to extend such a strategy to related rhodium complexes that feature a metal-silicon bond. The main substrate investigated was 4-(dimethylamino)pyridine (DMAP) due to its electron-donating and sterically unhindered C–H activation site ortho to the nitrogen. C–H activation of DMAP was not observed when carbonyl supporting co-ligands were utilized, but there is evidence of rich chemistry (including C–H activation) with other co-ligands. Additionally, important insights on the synthetic route to rhodium silyl pincer complexes and their reactivity with a variety of coordinating substrates.

17. Athena Brooks

Class Year: 2022
Major(s): Biology

Title: *Disrupting leukemia-meningeal cell adhesion to overcome acute lymphoblastic leukemia chemoresistance in the central nervous system*
Central nervous system (CNS) relapse accounts for 10% of acute lymphoblastic leukemia (ALL) reemergence in American children. Relapse is due to adhesion between leukemia and meningeal cells which causes leukemia cells to be chemoresistant. A hematopoietic stem cell mobilizer, Me6TREN, can

disrupt this cell adhesion by inhibiting CXCR4, a chemokine receptor that initiates integrin cell adhesion. However, this mobilizer is not a clinically approved drug that can be readily used in patients. A more available CXCR4 inhibitor is needed to disrupt the adhesion between meningeal and leukemia cells to prevent CNS relapse. We tested five analogs of Me6TREN that are clinically available to evaluate whether the same effects can be seen in vitro. These drugs were added to co-cultured leukemia and meningeal cells and were subsequently analyzed using flow cytometry to quantify non-adhesive leukemia cells. MSX-122, a competitive inhibitor for CXCR4, showed a significant amount of cell adhesion disruption compared to untreated and AMD3100, a commonly used hematopoietic stem cell mobilizer. This will cause leukemia cells to be less chemoresistant and more receptive to cell death with chemotherapy. Future directions include dose titrations of MSX-122, examining the effects of chemotherapy in combination with MSX-122, and in-vivo testing in mice.

18. Kevin Bui

Class Year: 2024
Major(s): Undecided

Title: *Discussify*
We decided to work on building the interface for our startup this previous summer after winning the Carleton 2021 Startup Fellowship competition. Using web technology, we hope to improve in-class discussions by making the small group environment more inclusive.

19. Eway Cai

Class Year: 2023
Major(s): Chemistry

Title: *Discovering Emerging Medical Technology*
Working as a market research intern at Siemens Healthineers Innovation Center Shanghai, I spent the summer conducting research and analysis on emerging technologies in the medical field. The four topics of interest are digital pathology, surgical robotics, surgical navigation and digital therapeutics. Throughout my internship, I focused on finding start-ups and products in these fields that may be good candidates for collaboration with my company.

20. Corrina Callahan

Class Year: 2024
Major(s): Undecided
Supervisor(s) and affiliation or institution: Helen Minsky (Assistant Professor of Physics, Carleton College)

Title: *Kirigami and Tunable Adhesives*
There are many different types of adhesives all with different strengths and applications. Tunable adhesives are of particular interest because their properties allow us to control how adhesive they are in different states. We found that the polymer polydimethylsiloxane (PDMS) can be manipulated to be more or less adhesive by making cuts in the material in kirigami patterns to allow it to be stretched

(where it becomes less adhesive). We further found that it can be bound to certain harder plastics to increase its rigidity in-plane. This technology has applications in fields like robotics and manufacturing, where picking up and releasing objects in a controlled way is crucial.

21. Alison Cameron

Class Year: 2022
Major(s): Computer Science
Other Authors/Contributors: Seth Dorchen
Supervisor(s) and affiliation or institution: Anya Vostinar (Assistant Professor of Computer Science, Carleton College)

Title: *Keep your frenemies close: Lysogenic bacteriophage benefitting their hosts evolve to be temperate populations*
Bacteriophages, viruses that target bacteria, are found everywhere in nature. Phages play vital roles in microbiomes as a result of selective pressure that they place on their hosts. As obligate symbionts, phages depend on bacteria for successful reproduction, and either destroy their hosts through lysis or potentially impact host fitness through lysogeny. Lysis involves reproduction within the host membrane and the eventual bursting of the cell to release their progeny. Alternatively, lysogeny is the process by which phage DNA is inserted into the host DNA, and thus the phage reproduces when their host reproduces. As such, phages can exist along the parasitism-mutualism spectrum, prompting the questions of how and why phage would evolve one reproductive strategy over the other. In our agent-based model, we found that a viral population with beneficial lysogenic phage can select against lytic strategies. This result has important implications for bottom-up control of various ecosystems.

22. Isabel Cannell

Class Year: 2022
Major(s): Chemistry
Supervisor(s) and affiliation or institution: Emily Mevers (Assistant Professor, Virginia Polytechnic Institute)

Title: *Characterization of Secondary Metabolites in Marine Egg Mass Microbiomes*
Secondary metabolites are compounds produced by organisms that are not needed for basic living functions. These compounds have strong therapeutic potential, and many antibiotics are either secondary metabolites or analogues thereof. As bacterial antibiotic resistance grows, there is a stronger demand for novel antimicrobials, but many easily discoverable bacterial metabolites have been searched. Using biology as a guide, we can predict some organisms that might produce secondary metabolites of interest. Marine egg masses, largely unprotected in their environments, have been hypothesized to have chemical defenses in the form of secondary metabolites produced by symbiotic bacteria. Using bacteria collected from moon snail eggs, we isolated metabolites with antibiotic activity.

23. Sarah Cauthorn

Class Year: 2022
Major(s): Chemistry
Supervisor(s) and affiliation or institution: Chris Calderone (Associate Professor of Chemistry, Carleton College)

Title: *Probing a Proposed Hydroxylation in the Biosynthesis of Bleomycin in Streptomyces verticillus*
Bleomycin is a natural product made by Streptomyces verticillus that has been widely studied for its antitumor properties. It is synthesized by a non-ribosomal peptide synthetase (NRPS). An NRPS is a string of catalytic domains that select amino acids for activation and loading onto a growing peptide chain. Because amino acids are added to the chain in the order of the domains, we can identify which domains and associated proteins act when. Using the logic of collinearity, we aimed to identify a protein involved in cyclization during bleomycin biosynthesis. We theorized that the cyclization occurred through the elimination of a hydroxyl group, so the protein was an upstream hydroxylase. The candidate studied was Orf3. We tested Orf3's activity as a hydroxylase of free asparagine and asparagine activated and loaded onto the NRPS. The data showed that Orf3 is not the asparagine hydroxylase and that the asparagine is hydroxylated after loading.

24. Isabella Chaffee

Class Year: 2022
Major(s): Cognitive Science

Title: *Summer Internship with URACA Basiliade*
I spent this summer working with the French non-profit URACA Basiliade based in Paris, France. The organization works on public health initiatives and chronic illness education among refugee and immigrant populations, primarily those coming from subsaharan African countries. Over the past decades, they have expanded their missions to include social work, helping beneficiaries make appointments to get visas and reviewing applications. Some of my roles included observing appointments, planning weekly assemblies and workshops, as well as some general research and communication tasks; all of which were completed entirely in French.

25. Garrett Chappell

Class Year: 2022
Major(s): Biology
Supervisor(s) and affiliation or institution: Rika Anderson (Assistant Professor of Biology, Carleton College)

Title: *Evolution and Radiation of Bacterial Sulfur Cycling Genes*
The sulfur cycle is involved in regulating the redox state and environmental conditions of Earth, and microbial metabolisms that involve sulfur have a significant role in that cycle. To investigate the evolutionary history of sulfur cycling genes, 13 genes essential to sulfur cycling in a wide variety of bacterial species were examined. Comparing the phylogenetic trees of the evolution of these genes to a time-calibrated species tree allows certain evolutionary events, including gene duplications, losses, and horizontal gene transfers, to be computed. Using the reconciliation software ecceTERA, the approximate dates for each of these events over the gene's history were calculated. This data illustrates when certain

genes became more biologically important and can be compared to the geologic history of the Earth. Additionally, some of these genes are used in the production of volatile organic sulfur compounds, which can be used as remotely detectable biosignatures. Overall, the results showed a peak in gene events around 750 million years ago and an earlier peak for sulfate reduction and oxidation at around 1.5 billion years ago, corresponding to trends shown previously in geochemical studies.

26. Theresa Chen

Class Year: 2022
Major(s): Computer Science, Environmental Studies

Title: *Using Machine Learning Techniques and ICESAT-2 Data to Analyze Sea Ice Features*
Climate change has lead to the rapid melting of the ice caps which has only accelerated in recent years. The NASA laser-based altimetry satellite ICESAT-2 provides highly accurate estimates of sea ice elevation. This research analyzed ICESAT-2 data using two machine learning techniques: a regression neural network and a classification neural network. The regression neural network was used to predict elevation of sea ice in areas that were unable to be measured by the ICESAT-2 satellite. The classification network was used to try to classify cracks, or leads, in the sea ice. The regression analysis was highly successful with high accuracy and low loss but the classification network was less successful in predicting where leads were in the sea ice.

27. Allen Cheng

Class Year: 2022
Major(s): Biology

Title: *Investigating Immune Cell Abundance in Pediatric Osteosarcoma*
The Webber Lab at the University of Minnesota was able to implant human induced pluripotent stem cells into a mouse and induce osteosarcoma within the mouse. RNA-sequencing data was extracted from these samples and compared to datasets of pediatric osteosarcoma from the St. Judes Childrens Hospital and the National Cancer Institute. The total RNA-sequencing data was thrown together into Cibersort, an online analytical tool for estimating the abundance of cell types in a sample. After sorting all the data into clusters, I generated a heatmap that showed the abundance of each immune cell type relative to the other clusters.

28. Eric Cheng

Class Year: 2023
Major(s): Statistics

Title: *Classical Conditioning of Asian Carp*
Given the literature regarding the efficacy of non-physical barriers in the prevention of invasive species as well the potential drawbacks in physical barriers, the Mensinger lab hopes to see if classical conditioning to sound can help serve as a deterrent to Asian carp. Carbon dioxide functions as a noxious stimulant, triggering an unconditioned response in carp. Carp will flee along the concentration gradient of carbon dioxide, or lose equilibrium in the process. In contrast, with sound barriers there is a gradual habituation to the stimuli after prolonged exposure. We hope that through classical conditioning, we can account for that habituation and induce a conditioned response.

29. David Chu

Class Year: 2023
Major(s): Computer Science, Statistics
Supervisor(s) and affiliation or institution: Aaron Bauer (Assistant Professor of Computer Science, Carleton College)

Title: *Behavior Analysis in Starcraft II*
The competitive online strategy game Starcraft II requires a lot of its players. Decision making under pressure, perfectly-timed muscle memory and precise information gathering are important parts of every match. In order to better understand human behavior in these situations, we collect 77,322 archived online matches and then extract and analyze several features with various statistical techniques, trying to find out which behaviors were advantageous and associated with higher skill. The features range from relatively low-level, like how often a player used their "macro mechanic", a timing-based ability that yields various positive effects, to high-level, like how often a player engaged in "scouting", an abstract term to describe a certain type of information-gathering behavior. We confirm prior work on the importance of speed in low-level actions, find non-linear differences in how players of different skill levels control their view of the game, and show that expert-level scouting differs in amount, but not temporal distribution, from novice-level scouting. We asses the predictive power of our features by using Gradient-Boosted Decision Trees as a model for predicting the winner of a match and the skill level of both players involved, achieving accuracies of 69.5% and 82.5% respectively.

30. Jackson Cleveland

Class Year: 2023
Major(s): Chemistry
Supervisor(s) and affiliation or institution: Matt Whited (Associate Professor of Chemistry, Carleton College)

Title: *Achieving Regioselective C-H Activation Through Silicon/Iridium Cooperation*
Regioselective C-H bond activation is a promising strategy for organic synthesis yet has proven challenging to achieve due to the large number of C-H bonds that exist in most molecules and the inherent strength of the C-H bond. One common strategy for selectivity utilizes a transition metal catalyst that can precoordinate substrates with Lewis basic sites, holding them in place and directing the metal to activate a certain C-H bond. In this project, we have explored a distinct approach in which, instead of the substrate binding to the metal and then being activated by that same metal, the substrate binds to a silicon Lewis acid prior to selective C-H bond cleavage by a nearby iridium metal center.

Here we report synthetic routes to such complexes as well as initial forays into the C-H activation reaction. These first attempts yielded promising signs of the theorized activation reaction, including the presence of both C-H activated and unactivated products in equilibrium, consistent with computational predictions, but more work remains to be done in this area. Thanks to the new understanding we gained of the workup synthesis throughout this research period, future research will have the opportunity to more efficiently study this promising regioselective C-H activation reaction.

31. Ashley Cohen

Class Year: 2024
Major(s): Undecided
Supervisor(s) and affiliation or institution: Tsegaye Nega (Associate Professor of Environmental Studies, Carleton College), Deborah Gross (Professor of Chemistry, Carleton College)

Title: *Designing a New Website for Anega Energies*
Over this past summer, I assisted my Environmental Science Professor Tsegaye Nega and his partner Deborah Gross with the task of redesigning the website for his company Anega Energies. The company aims to produce and provide sustainable cookstoves for people in Ethiopia who suffer from the dangerous effects of indoor air pollution, while simultaneously promoting sustainability with clean burning, waste fueled stoves. By renovating the website, information about the project is more accessible to anyone wanting to learn about this issue and potential buyers can more easily navigate the site. This was the first time I experienced working alongside an educator or contributed to a project of this scale, and over the course of my internship I have taught myself how to generate my creativity through modern outlets, developed my efficiency working with a team and realized my interest in design.

32. Acacia Coker

Class Year: 2024
Major(s): Undecided

Title: *TMEM127 Regulation of RET Accumulation and Activation*
TMEM127 is a poorly known tumor suppressor gene mutated in neuroendocrine tumors. Recently we found that TMEM127 loss results in the accumulation of the RET oncogene, but the mechanisms are currently unknown. Our goal in this project was to identify the process through which TMEM127 regulates RET. We generated two neuroblastoma cell lines lacking TMEM127 (T2 and T4 knockout- KO) and evaluated proteasomal and lysosomal RET degradation in these cells with bortezomib (BTZ) and chloroquine (CQ) to measure the accumulation of RET, its two differentially glycosylated forms (which reflect RET preferential localization) and downstream signaling (pRET, pAkt, pERK, and pSTAT3). We discover that the RET profile is stagnant in KO cells both after the short-term and long-term BTZ. Fully glycosylated RET (predominantly localized to the plasma membrane) is resistant to BTZ treatment in KOs. RET accumulation after CQ is flatter in KO cells than in control. Levels of RET autophosphorylation and downstream signaling are higher in KOs at baseline, and they are responsive to GDNF. Both RET isoforms are accumulated in KOs. These results point towards proteasomal regulations as a potential avenue in which TMEM127 regulates RET. Further research is needed to verify this inference and rule out or incorporate the method of lysosomal regulation.

33. Mika Cooney

Class Year: 2022
Major(s): Mathematics

Title: *Diophantine m-Tuples*
Diophantine m-tuples are sets of numbers that have the property that whenever you multiply any of the numbers together and add some constant n, you get a square number. For example, a Diophantine quadruple would be the set {1,3,8,120} because if you multiply any two distinct numbers from that set and add 1, you get a square. These sets have long been an interest in mathematical research, partially because of the relationship between the sets and elliptic curves. Elliptic curves can help predict which

sets of numbers will have the desired property, and often these elliptic curves help in things like crypto-security.

34. Ineke Cordova

Class Year: 2022
Major(s): Psychology

Title: *Pay Attention*
I spent the summer working in the Tse lab at Dartmouth College as a research assistance. Under the guidance of Gideon Caplovitz, Taissa Lytchenko, and Sharif Saleki I worked on several different projects relating to object based attention and visual perception. I was even able to design and run my own experiment collected data for over 1,300 participants. Much of the data from the summer will be analyzed for my psychology comps on object based attention. Throughout the summer I had invaluable experiences which built my research skills and my knowledge of PhD life and expectations. What I learned has shaped what I plan to do post graduation as I know wish to pursue a lab manager or research assistant position in an interesting before my PhD.

35. Alé Cota

Class Year: 2022
Major(s): GWSS, Latin American Studies

Title: *Queer-Romancing: Sensuality, Futurity, and the War on Intimacy in Ocean Vuong's On Earth We're Briefly Gorgeous*
I explore the routine hypersexualization of queer intimacy as portrayed in the literary canon. The adverse effects on youth of this phenomenon are juxtaposed with the progress driven by socio-political LGBTQ+ movements. I engage in a close reading of Ocean Vuong's memoir-novel On Earth We're Briefly Gorgeous as both a cultural product and historical case study. Through an interdisciplinary lens, I draw from Black feminist, cultural, and queer studies, and utilize "queer utopia," "decolonial love," and a "love ethic" as theoretical concepts that I synthesize into my novel analysis—"queer-romancing." This approach opens up avenues that affirm healing from trauma and shame without centering sex. Vuong's queer narrative of color explores healing and restorative moments of liberation situated outside the precarious politics of racialized and gendered sex. In essence, Vuong's memoir-novel can be read as a text that embodies the interdisciplinary characteristics of the "queer-romancing" framework I put forth.

36. Isaac Crown Manesis

Class Year: 2023
Major(s): Cinema and Media Studies

Title: *Facets 2021 Summer Internship Festival Programing Assistant and Summer Camp Assistant*
In my role as a Festival Programming Assistant Intern, I worked with a team under the direction of CICFF's programer, Deidre Searcy, and Facets's Youth Programs Coordinator, Jake Laystrom. CICFF is the oldest children's film festival in the United States and the largest in the world. It is also the first Academy Award® qualifying children's film festival in the world. In my final weeks, I participated in the creation of programming notes which will accompany selected submissions. I also assisted with six different

summer camp programs throughout my internship. Most were online, several hybrid, and one was fully in person.

37. Ella Cunningham

Class Year: 2024
Major(s): Undecided

Title: *Farm Intern in Windham, VT*
I spent two months on a small, educational farm in southern Vermont, where I learned about the world of small farming, and it's place within the greater food system. I helped wherever needed on all aspects of the farm, including running an educational farm camp.

38. Maia Danks

Class Year: 2022
Major(s): Studio Art, Biology

Title: *Interning at Kids Saving the Rainforest*
This summer, I was a sanctuary intern at Kids Saving the Rainforest, an animal sanctuary and rehabilitation center in Costa Rica for 2 ½ months. The sanctuary contained 34 animals, almost all native to Costa Rica. My job there consisted of preparing food and feeding the animals twice per day as well as cleaning their cages every morning. When the two zookeepers and I finished with these activities, we would do general upkeep of the sanctuary to ensure that the animals were happy and healthy. I was also in charge of doing enrichment for our curassow because he was alone, so we needed to provide him with extra enrichment through handmade toys for him to play with.

39. Hannah Davis

Class Year: 2023
Major(s): Political Science/International Relations

Title: *Analyzing the Efficacy and Ethicality of Wisconsin's GPS Tracking Program*
Over the course of my internship, I investigated Wisconsin's GPS tracking program (primarily used for sex offenders) as a part of Wisconsin Watch's Losing Track Series on the program. I spoke to about a dozen device-wearers, attorneys, and a representative from the Department of Corrections in order to create a long-form investigative piece digging deep into medical, psychological, economic, and legal impacts.

40. Andi Delgado

Class Year: 2022
Major(s): Biology
Supervisor(s) and affiliation or institution: Mike Nishizaki (Assistant Professor of Biology, Carleton College)

Title: *Reduce, Reuse, Respire: Two Environmental Factors' Effects on Mussel Respiration*
Mussels are ecosystem engineers within the intertidal and are under threat of increasing ocean temperatures & could be made more vulnerable as a result of low wave action. Physiological performance of Mytilus trossulus was quantified by measuring respiration rates under five water temperatures (e.g., 5, 11, 17, 23, & 29° C) & flow velocities (e.g, 2, 4, 6, 10, & 20 cm s-1) in a fully crossed design. Results suggest an interaction between temperature & flow impacting respiration rates. At the highest flow of 20 cm s-1, mussels had higher respiration rates and were consistent at flows of 4, 6, and 10 cm/s. However, at the lowest flow of 2 cm/s, respiration rates were higher than intermediate flows. This can be applied to future research into performance in mussel beds under future climate conditions, with mussels deeper within the bed being able to respire at lower flows contrary to prior thought.

41. Jennifer Delgado

Class Year: 2022
Major(s): Geology

Title: *The Mill Creek Dam Removal: Re-rooting STEM in Indigenous Knowledge*
This summer I had the opportunity to document the beginnings of the Mill Creek Dam removal with the Amah Mutsun Land Trust through the Doris Duke Conservation Scholars program. Through film, interviews with different community members and organizations, and participation in multiple projects led by the Amah Mutsun, I was able to explore the importance of storytelling and collaboration in conservation fields, especially in projects involving Indigenous peoples and scientific institutions and organizations.

42. Lydia Dilulio

Class Year: 2022
Major(s): Biology
Other Authors/Contributors: Clarissa Guzman

Title: *In the Community with Growing Up Healthy*
In this presentation, Clarissa and I will give an overview of the work completed during our time at our summer internship with Growing Up Healthy (GUH). GUH is a non-profit that works primarily with Latine families in the Rice County Area, providing a wide variety of community services but focusing on early childhood learning and housing issues. Over the summer, we coordinated GUH's flagship summer event, Evenings in the Park/Tardes en el Parque. We also recruited participating families to GUH's Home Energy Squad (HES) program, and then provided Spanish/English translation for HES visits. Finally, helped to plan and execute GUH's Heat Tape Campaign, a new initiative this summer in partnership with Hosanna Church of Dundas.

43. Zach DiNardo

Class Year: 2022
Major(s): Chemistry
Supervisor(s) and affiliation or institution: Dani Kohen (Professor of Chemistry, Carleton College), Matt Whited (Associate Professor of Chemistry, Carleton College)

Title: *Computational Investigation of C-H Activation by Group 9 Transition Metal Silyl Complexes*
Breaking carbon-hydrogen bonds is synthetically important yet energetically difficult due to their stability, and achieving high selectivity is complicated by the fact that such bonds are ubiquitous and difficult to discriminate. Using a metalloid/metal pair held together in a pincer complex can help to circumvent both of these difficulties by using known C–H bond activators, such as iridium, to break the bond, and using electron pair acceptors, such as silicon, to bind the substrate at a specific location and direct the process. These pincer complexes have several distinct and variable features: the nonmetal binding site, the metal activator, the phosphine donors of the pincer, and the additional ligands bonded to the metal. Using density functional theory, we have examined the effects of varying these parts of the complex on the thermodynamics of breaking the carbon-hydrogen bond. These computational methods verify the suspected high-energy transition state during the C-H activation step and provide insight into which combinations of components will thermodynamically favor bond activation.

44. Larry Donahue

Class Year: 2022
Major(s): Physics
Supervisor(s) and affiliation or institution: Jay Tasson (Associate Professor of Physics, Carleton College)

Title: *Continuing Development of a Search Tool for LIGO Noise Data*
The Laser Interferometer Gravitational-Wave Observatory (LIGO) is an observatory used to collect data on stellar events through the spacetime waves it detects. Despite advancements in the detection instruments used over the years, they are still sensitive to noisy environmental effects. "Lines" are a data feature consisting of a distinctly increased amplitude at a well-defined frequency that arise from detection of some signal. The detector characterization work that this project assists compares found lines to local environment monitors that help distinguish between astrophysical and local signals. In this project, we continue development of an online tool called Linefinder that stores and presents this comparison data for lines appearing in LIGO observing periods.

45. Marc Donnelly

Class Year: 2022
Major(s): Environmental Studies

Title: *Understanding the Relationship between Gray Whale Behavior and Habitat Across Spatial Scales*
The Pacific Coast Feeding Group (PCFG) of gray whales (Eschrichtius robustus) forage every summer off the coast of Oregon, USA. This nearshore habitat use provides an ideal opportunity to generate a baseline understanding of the spatial patterns of gray whale behaviors and their associations with habitat type. An exploration of the relationship between behavior and environment will inform future efforts to evaluate the consequences of this association as it pertains to social dynamics, reproductive rates and other factors relevant to the health of a population. To quantify this relationship, behavioral classifications were made from sightings via boat- and drone-based observations and a series of benthic habitat maps will be created through extrapolation of environmental characteristics identified from GoPro drop footage. The relationship between gray whale behavior and habitat type was tested at various spatial scales to elucidate how these changes in scales affect the relationships between whale behavior and habitat.

46. Allison Drennan

Class Year: 2022
Major(s): History

Title: *Historic Preservation in Charleston, South Carolina*
I interned with the historic preservation nonprofit, Historic Charleston Foundation, and learned about their initiatives to increase affordable housing, protect historic properties, and keep people's stories alive through publicly accessible oral history transcriptions.

47. Angela Ellis

Class Year: 2023
Major(s): Computer Science

Title: *Life at an Anglican Monastery with Forty-Four Cashmere Goats*
This summer, I had a monastic internship at the Community of St. Mary's in Greenwich, New York. For two months, I adopted the Benedictine Rule of Life and lived beside the four sisters. My daily schedule consisted of prayer, caring for their goats, and learning about their way of life through intentional conversations and my personal experiences. I wanted to partake in this internship to understand why individuals would choose to depart from the prevailing culture to live a life characterized by poverty, obedience, and stability.

48. Tali Emlen

Class Year: 2022
Major(s): Geology

Title: *Food Access Summer Internship*
I worked with Colleen Milligan '22 for the Community Action Center of Northfield (CAC). Together we coordinated a free farmers market for people experiencing food insecurity and helped with food shelf tasks.

49. Keyra English

Class Year: 2022
Major(s): Cinema and Media Studies

Title: *White: a Stop Motion Short*
Thanks to the Special Arts and Tech fund, I was able to accept a one-of-a kind opportunity this summer. Professor Peter B Nelson, a professor and department head of the Art and Art History department at St. Olaf, asked me if I would be interested in spending my summer as part of the team producing his short, stop motion film, White. I was thrilled by the chance to work on a collaborative project, gain experience in an animation medium I've never tried before, and to discuss an experience of whiteness in America.

50. Dawson Eriksen

Class Year: 2023
Major(s): French, Religion
Other Authors/Contributors: Connor Jansen
Supervisor(s) and affiliation or institution: Michael McNally (John M. and Elizabeth W. Musser Professor of Religious Studies, Carleton College)

Title: *Public Scholarship in Religious Studies: ReligionMN*
This summer, we edited and contributed additional research to the website and public scholarship project called ReligionsMN. Our work covered a very wide range of religious stories and traditions rooted in Minnesota but connected more broadly to diverse geographies and peoples around the globe. Connor's primary areas of focus were religious responses to the COVID-19 pandemic and an ethnographic study of a South Minneapolis Catholic church that serves both an English-speaking community and an enormous Spanish-speaking community. He also contributed to the introductions of the many traditions included on the website. Dawson contributed original research on queer religion in Minnesota and focused also on Minnesota religious history. They also edited the site's pages about evangelicalism in Minnesota, which problematize common stereotypes. This project's main goal was to increase awareness of the diversity of religious life in Minnesota.

This experience was funded by: Dean of the College Office SRP

https://religionsmn.carleton.edu/

51. Soren Eversoll

Class Year: 2024
Major(s): Undecided
Other Authors/Contributors: Eunice Gao

Title: *The Carleton Student Farm*
Over the summer, I worked with two other interns to plan, take care of, and harvest crops in a 1.5 acre farm at Carleton, which we eventually sold to Carleton's catering service, Bon Appetit. The internship was a wonderful chance to take ownership of a project, work with other students, and expand my knowledge of farming, sustainability, and how modern farmers operate.

52. Pinchen Fan

Class Year: 2022
Major(s): Physics
Supervisor(s) and affiliation or institution: Erik Katsavounidis (Senior Research Scientist, Massachusetts Institute of Technology), Geoffrey Mo '19 (Graduate Student, Massachusetts Institute of Technology)

Title: *Comparison of Skymaps from Multiple Gravitational-Wave Event-Finding Methods*
Real-time searches for GW transients with LIGO-Virgo invoke multiple searches for the identification of such events, each resulting in separate sky maps that describe the error area of the candidate source. In this work, we study the similarities of sky maps from the different methods considered and compare them with ones obtained from offline analyses that use sophisticated stochastic samplers. Understanding the relatedness of such sky maps obtained in real time is important for the prompt

follow-up of GW candidates in the electromagnetic spectrum and in neutrinos, as well as in helping discriminate noise events from signals. We will report on a preliminary analysis of these sky maps using a sub-set of the public alerts from LIGO-Virgo in O3.

53. Elizabeth Farr

Class Year: 2022
Major(s): Biology

Title: *The Role of miR9 and its 5q14.3 Enhancer in Retinal Vasculature*
Macular Telangiectasia type II (MacTel) is an inherited retinal disorder characterized by aberrant patterning of the retinal vasculature. MacTel is associated with a variant in the 5q14.3 enhancer, which regulates the expression of microRNA9-2 (miR9-2). We investigated the role of miR9-2 and its 5q14.3 enhancer in the development of the retinal vasculature using genetic knock-out mouse lines. We found that mice lacking miR9-2 show differences in the organization of the retinal vasculature, including an increase in the number of arteries compared to wild-type, while mice lacking the 5q14.3 enhancer appear similar to wild-type. Overall, the results suggest that miR9-2 plays a role the development and organization of retinal vasculature, but further investigation is needed to fully characterize this effect.

54. Grace Farwell

Class Year: 2023
Major(s): Linguistics
Supervisor(s) and affiliation or institution: Julia Strand (Associate Professor of Psychology, Carleton College)

Title: *What Features of a Talking Facilitate Speech Recognition?*
As anyone who has conversed in a noisy environment can attest, seeing a speaking face while engaged in conversation typically facilitates speech recognition. The current research assesses which features of a talking face are the most beneficial to speech comprehension. Using Python, we have created several types of stimuli, which identified facial landmarks and converted talking-face video into a minimalistic representation. We manipulated these videos, omitting certain features (lips-only, no jaw, etc.) and created versions that were collections of only dots, drawing from research into Point-Light displays. We plan to assess whether minimal visual signals (including some that only provide temporal information about speech) can provide recognition benefits. This work will help to explain how listeners combine what they see with what they hear.

55. Maya Feldberg-Bannatyne

Class Year: 2023
Major(s): Geology

Title: *Reconstruction of the Mid Atlantic Bight Oceanic Conditions Using Sclerochronology*
The lack of oceanic instrumental records going back more than 60 years stymies the ability for oceanic researchers to begin to understand one of the most mysterious and complex systems and therefore use of proxies is necessary. Arctica islandica, the Ocean Quahog, is a high-resolution proxy because it grows in annual increments. Comparing growth patterns of shells from one location determines if there was a

climate signal influencing growth. Isotope analysis with comparison to sensor-provided data allows for the reconstruction of specific conditions such as salinity and temperature. This project aims to fill in the gaps of instrumental data to determine the location of the Mid-Atlantic Bight Cold Pool in the past 400 years in hopes of understanding the anthropogenic impact on Cold Pool location. The Cold Pool provides habitat for many of the commercial shellfish and therefore changes in the future can dramatically impact the East Coast fishing industry.

56. Max Felland

Class Year: 2023
Major(s): Biology

Title: *Visualizing molecular chaperones in C. elegans using a system of split fluorescence*
Molecular chaperones participate in protein folding, proteome maintenance, and are critical to proteostasis. Proteostasis declines with age and in many neurodegenerative diseases, leading to protein misfolding and aggregation that is no longer able to be resolved by molecular chaperones as it was in a healthy system. To investigate the dynamics of chaperone function during aging and pathology, C. elegans were used to visualize the Hsc70 and Hsp90 conserved chaperone systems. Since the genes encoding these chaperones are essential, a split-fluorescent system was utilized to minimize any disruption that may be caused by attaching a large fluorescent protein to the dynamic chaperone proteins. This system also allows for visualization of the protein of interest in specific tissues by using different genetic backgrounds. These strains of C. elegans will be tools used in determining Hsc70 and Hsp90 amounts and localization patterns during stress, aging, and disease.

57. Lydia Fick

Class Year: 2022
Major(s): Physics
Other Authors/Contributors: Ben Hafner
Supervisor(s) and affiliation or institution: Helen Minsky (Assistant Professor of Physics, Carleton College)

Title: *Automated Leveling Apparatus for Probe-Tack Tests*
A common method for measuring adhesive properties is a probe-tack test, where the force on a rigid probe is recorded as it is pulled off of a sample material. In order to achieve accurate adhesive force measurements with flat probes, the surface of the sample must be leveled to the probe face within 0.01°. In our lab we test samples of Polydimethylsiloxane (PDMS) using flat glass probes attached to a tensile tester which moves the probes while recording force, position, and time data.

Our goal was to engineer an apparatus for accurate automated leveling. We designed and constructed a machine that finely adjusts the sample angle, using the Nelder-Mead search algorithm to determine the most level position by optimizing pull-off force. This method achieves better than 0.01° accuracy. Our leveling apparatus will allow us to run tests more easily and examine how sensitive adhesive force is to sample angle.

58. Keely Fisher

Class Year: 2022
Major(s): Environmental Studies

Title: *The Benefits of Outdoor Adventure Recreation: A Longitudinal Study of Impacts and Young Adults' Perspectives*
Outdoor activity positively influences youth development. This study aims to understand how impacts continue into young adulthood. Interviews were conducted with individuals (N=9) in their mid-20's to early 30's who had attended monthly adventure recreation outings during adolescence through the Youth Outdoors Program in Cleveland, Ohio. All had participated in a previous study of impacts in 2007. Analysis using MaxQDA indicated that sense of belonging, relationships, and challenge and enjoyment of activities were important. Participants discussed leadership, stress management, and other skills that remain relevant. Implications include improvements for the program and providing opportunities for others to participate.

59. Brie Forster

Class Year: 2022
Major(s): Biology
Supervisor(s) and affiliation or institution: Anne Kwitek (Medical College of Wisconsin), Valerie Wagner (Medical College of Wisconsin)

Title: *Sex Differences in Liver Ugt1a9 Gene Expression in Heterogenous Stock Rat Founding Inbred Strains*
An enzyme (Ugt1a9) that is expressed in the liver metabolizes the endocrine disruptor, bisphenol F, which is known to increase adiposity in humans. Sex and genetic background may influence susceptibility to BPF exposure in rats, although the relationship between these factors and Ugt1a9 expression is unknown. The goal of this project was to analyze Ugt1a9 expression in inbred rat strains to determine whether sex or genetic background influence expression of the gene. RNA was isolated from liver samples of young males and females from four genetically different rat strains. Ugt1a9 qPCR experiments were run using Gapdh and Actb as endogenous controls. We identified interstrain differences in Gapdh and Actb expression, making them poor controls for analyzing Ugt1a9 expression differences between strains, although they are sufficient for intrastrain sex comparisons. Females from one strain (F344) showed increased Ugt1a9 expression compared to F344 males, while no expression differences between sexes were found in the other strains.

60. Jocelyn Franco

Class Year: 2022
Major(s): American Studies
Supervisor(s) and affiliation or institution: Adriana Estill, Professor of English and American Studies, Carleton College

Title: *The Influence of Marianismo in the Experiences of Latinx Daughters as Represented Throughout I Am Not Your Perfect Mexican Daughter*
The contemporary Young Adult novel I Am Not Your Perfect Mexican Daughter by Erika Sánchez explores the experiences of Latinx daughters through the perspectives of Julia and Olga Reyes. The representations of their experiences provide insight into how factors, such as that of Marianismo,

impact the expectations and treatments Latinx daughters face within their household. For sociologists and psychologists, Marianismo depicts a gender role phenomenon of behavior that is deemed both acceptable and expected for women to incorporate and embody regarding their gender and sexual roles. In my close reading of this text, I investigate the way the representation of mother-daughter relationships within Sánchez's Young Adult novel demonstrates the conflict between Marianismo's influence and gender role expectations in the United States.

61. Elias Franzen

Class Year: 2022
Major(s): Environmental Studies, History

Title: *Water Policy Internship with the Environmental Policy Innovation Center*
This summer I had the pleasure of spending eleven weeks working as an intern for the Environmental Policy Innovation Center (EPIC). As a small, but focused, organization I came to know the staff and issues well, and truly feel that I was able to contribute to the work at hand. As an intern, broadly speaking, the scope of my work focused on drinking water. What I had previously assumed to be a relatively simple policy and infrastructure mechanism, revealed itself over the course of the summer to be far more complicated. There was not one perfect solution that had been reached, and health and economic inequalities continued to persist. This realization of greater complexity was likely my greatest take away from the internship. My work in particular focused on two separate issues, water utility consolidation and funding for lead pipe removal.

62. Miriam Freedman

Class Year: 2022
Major(s): Psychology

Title: *Summer Internship Work*
I worked at a cognition lab at the University of Michigan.

63. Eunice Gao

Class Year: 2024
Major(s): Undecided

Title: *Carleton Farm Internship*
We've spent the past six months as farm interns running the Carleton Student Farm. In early spring, we read books on organic farming and examined past years' field maps to prepare for the growing season. We then chose crops and planned a seeding, transplanting, and harvesting timeline based on Bon Appetit and the Community Action Center's (CAC) input. By midsummer we began harvesting and selling produce to Bon Appetit, the CAC, and students, faculty, and alumni at pop-up sales. When classes started, we organized student volunteer days to keep up with harvesting. Soon we'll be preparing for winter and hiring next year's interns!

64. Katherine Geist

Class Year: 2024
Major(s): Undecided
Supervisor(s) and affiliation or institution: Daniela Kohen (Professor of Chemistry, Carleton College)

Title: *Molecular Insights in Cation Behavior in Zeolites*
Zeolites are microporous crystalline aluminosilicate materials that are available in a variety of structures and chemical compositions and have a high degree of stability. Due to their porous nature and the presence of extra-framework cations, zeolites have the ability to selectively adsorb and store gases within their framework, opening the door to a plethora of industrial applications. Our research uses computational chemistry to investigate the role that extra-framework cations play in selective adsorption with the hope of being able to better characterize adsorption and synthetically design zeolites tailored for carbon capture industrial applications.

This experience was funded by: NSF Grant

65. Kamala GhaneaBassiri

Class Year: 2022
Major(s): Religion

Title: *Exhibition Research for the Oregon Jewish Museum and Center for Holocaust Education*
This summer, I did exhibition research on Salvador Dali's twenty-five commissioned lithographs commemorating Israel's 20th anniversary for the Oregon Jewish Museum and Center for Holocaust Education. I was working closely with the Director of the museum to brainstorm various entry points into contextualizing and explaining these lithographs within their historical context and attempting to make connections to the current Israel-Palestine conflict. This exhibit was meant to be the museum's way of addressing the conflict.

This experience was funded by: Rob White '85 Endowed Internship Fund

66. Fiona Gillen

Class Year: 2023
Major(s): Cognitive Science

Title: *Lakota Language Preservation on Pine Ridge Reservation*
This summer, I worked with the Lakota Language Immersion Program on Pine Ridge Reservation, SD, to help preserve the native language and culture. Working alongside Carleton alum Peter Hill '00, I aided with the program's summer camp and helped to create online learning materials in Lakota. I also created artwork to accompany translated children's books. Living on the reservation, I was able to learn about the culture of the Oglala Sioux tribe, attend native ceremonies, and walk away with a passion for Native American rights and lasting connections.

This experience was funded by: Social Justice Internships funds from the Chaplain's office

67. Maanya Goenka

Class Year: 2022
Major(s): Computer Science

Title: *systemd-analyze*
This summer I worked on the Linux Systems Group Team of Microsoft where I designed a static analysis tool which can be used when building an Overlake agent in order to ensure that the systemd service units meet certain verification and threshold requirements before being deployed or even uploaded. I enhanced the 'verify' and 'security' features of systemd-analyze to make the debugging process easier for internal customers and make sure the code they were producing was higher quality.

This experience was funded by: Student Internships Endowed Fund

68. Elijah Goldberg

Class Year: 2022
Major(s): Biology

Title: *My Summer Experience Working at Dodge Center Ambulance Services*
This summer I worked at Dodge Center Ambulance Services, a rural emergency medical services provider based in Dodge Center, Minnesota. As a company, DCA provides both basic life support and advanced life support and responds to around 1000 calls per year in Dodge Center, the nearby towns of Kasson, Mantorville, and Claremont. As an Emergency Medical Technician, I was allowed to intern with the company and provide medical support and emergent ambulance transport in response to 911 calls throughout the summer.

This experience was funded by: Student Internships Endowed Fund

69. Louisa Grader

Class Year: 2024
Major(s): Undecided
Other Authors/Contributors: Nate Bauer

Title: *Todd Lippert Campaign*
For this internship I worked on the campaign of Minnesota State Representative Todd Lippert. Projects involved helping with canvassing door knocking, some event planning and attending various conferences.

This experience was funded by: Jean Phillips Memorial Internship Fund

70. Esme Graham

Class Year: 2022
Major(s): Art History

Title: *Exploring Curation at the Rochester Art Center*
Over the summer I worked as the assistant to the curator at the Rochester Art Center in Rochester, Minnesota. The Head Curator of the art center was Zoe Cinel, and I worked with her directly. At the art center I was tasked with doing research for upcoming exhibitions, speaking with artists to coordinate artist talks, working to install exhibitions and ultimately curating an exhibition myself. This exhibition was meant to celebrate young queer artists in Rochester who may have not had their work exhibited before. I was in charge of writing the call for artists and selecting and curating the works.

This experience was funded by: Class of 1963 50th Reunion Fund for Internships

71. Riley Gudgel

Class Year: 2022
Major(s): Economics, Political Science/International Relations

Title: ***Measuring the Effects of Community Development Initiatives in Dublin, Ireland***
I worked with the Think Tank on Action for Social Change (TASC) in Dublin, Ireland on a multitude of research projects dealing with poverty and covid-relief management. The largest project I worked on was with the North East Inner City Co-op to conduct research on the effectiveness of their nearly 30 community development programs that dealt with drug addiction, alcoholism, homelessness, medical care access, and food insecurity. Our final report was submitted to the Dublin City Community Council for review and was cited by a number of Irish parliament members in their policy proposals that same summer.

This experience was funded by: (West Endowed) Initiative for Service Internships in International Development

72. Marianne Gunnarsson

Class Year: 2022
Major(s): Chinese
Other Authors/Contributors: David Ahrens
Supervisor(s) and affiliation or institution: Shaohua Guo (Associate Professor of Chinese, Carleton College)

Title: ***From Wanghong to Tuhao: The Culture of Livestreaming in Contemporary China***
What is popular culture? And how does it grow in tandem with the Internet and associated phenomena? This research explores an aspect of pop culture in China: live-streaming, an industry which comprises 130 million streamers or anchors and 617 million active users, all the while examining consumerism, the urban-rural divide in content creation, and how individuals craft star personae in the online sphere. Through engaging in guerilla ethnography of live-streaming apps such as YY, Douyu, and Huya TV, as well as by reading scholarly articles on Chinese popular culture, we find a sphere encompassing a range of content creators varied in socioeconomic status, geographic location, gender, and vocation.

This experience was funded by: Humanities Center SRP

73. Anna Gwin

Class Year: 2022
Major(s): Political Science/International Relations

Title: ***Collaboration in Conservation: Tracking Marmots & NGO Relationships***
I interned with Ilbirs Foundation, a Bishkek-based conservation organization, to conduct research on marmot populations in Kyrgyzstan and observe how partnerships between community organizations and international organizations sustain long-term conservation efforts. My main activities included Russian-English translation, reformatting the organization website, and working with an AI to identify marmot burrows in drone photos of snow leopard habitat. Additionally, Ilbirs provided a welcoming space for conversations about how relationship dynamics between local NGOs and internationally-based NGOs influence partnership outcomes, a topic I hope to research further in the future.

This experience was funded by: (West Endowed) Initiative for Service Internships in International Development

74. Clay Haddock

Class Year: 2024
Major(s): Undecided

Title: *Social Justice Internship: Lakota Immersion Program*
My experience at Pine Ridge and Red Cloud began by spending time with the students of the school, learning about and settling into the community. During my stay, I helped the school by drawing graphics for childrens' books and creating learning aids for the students. Additionally, I was able to assist Red Cloud High School in applying for a grant for their athletic department, and during this time I had the opportunity to get to know the school administrators. The time I spent helping the school was both challenging and rewarding, but the most meaningful part of my experience at Pine Ridge was the community I built.

This experience was funded by: Social Justice Internships funds from the Chaplain's office

75. Eva Hadjiyanis

Class Year: 2023
Major(s): Sociology/Anthropology

Title: *Community Organizing Internship: IAF Northwest*
This internship took place at the Industrial Area Foundation Northwest office, located in Portland, Oregon. It consisted of work such as community organizing trainings, relational meetings, research projects, and web design. Through trainings, conversations, and hands on work, interns developed a sense of the process and responsibilities of working as an effective community organizer.

This experience was funded by: Social Justice Internships funds from the Chaplain's office

76. Charlie Hall

Class Year: 2022
Major(s): Physics

Title: *Characterizing Nanobubbles at the Copper-Graphene Interface*
With remarkable impermeability at single atom thickness, it is desirable to understand Graphene's behavior as an anti-corrosion coating including how it interacts with water and air. When a Graphene-coated Copper sample was heated under ultra-high vacuum, "nanobubble" formations were discovered that were visibly different from the typical Copper oxide structures. It was hypothesized that the bubbles are filled with oxygen gas. This project studied the chemical composition of the nanobubbles using the Scanning Auger Electron Nanoprobe as well as the mechanical behavior using Atomic Force Microscopy.

This experience was funded by:

77. Wenlai Han

Class Year: 2023
Major(s): Chemistry
Supervisor(s) and affiliation or institution: Matthew T. Whited (Associate Professor of Chemistry, Carleton College)

Title: *Metal-Silicon Cooperative Conversion of Alkyl Azide to Isocyanate Enabled by a Labile Si-OTf Interaction*

Metal silyl complexes have been useful platforms to cooperatively functionalize organic substrates by taking advantage of an electropositive silicon adjacent to the metal. However, such systems normally require an unsaturated metal center to engage reactants. Alternatively, we have explored whether silicon can provide such vacancy for incoming substrate by weakly bonding to a labile group that can leave to initiate reaction. This principle was first demonstrated with pyridine N-oxide to transform Si–Co to Si–O–Co, but the product was reluctant for further transformation. However, use of azide successfully led to nitrene insertion, affording a proposed Si–NR–Co intermediate that couples nitrene with carbon monoxide to generate isocyanate, and the associated catalytic process is also efficient (quantitative conversion at 5% loading of Co). Mechanistic studies demonstrating the unique role of the Si–Co interaction in this process will be presented.

78. Bailey Harmon

Class Year: 2023
Major(s): Biology
Supervisor(s) and affiliation or institution: Allison Dyevoich (The University of Texas MD Anderson Cancer Center), Stephanie Watowich (Professor of Immunology, The University of Texas MD Anderson Cancer Center)

Title: *Differences in In Vivo and In Vitro cDC1 Maturation After Stimulation with Different TLR Agonists*

Conventional dendritic cells type I (cDC1s) are efficient antigen-presenting cells, mediating adaptive immune responses throughout the body. We cultured in vitro cDC1s to mimic in vivo cDC1s and sought to determine their similarities and differences in activation and function. Both cell types were stimulated with TLR agonists: Poly I:C, Imiquimod, or combination. We measured the upregulation of cDC1 maturation markers, which were greatest at 24-hours post-stimulation for both cell types. MHC I, MHC II, and CD40 are most upregulated by Poly I:C and combination treatment in in vivo cDC1s, but not upregulated in in vitro cDC1s. Poly I:C and combination treatment upregulated CD80 for both cell types, however, in vivo cDC1s showed greater upregulation. In vitro cDC1s showed greater basal CD86 expression. Both cell types upregulated CD86 for all treatments. In summary, activation of in vitro and in vivo cDC1s differs depending on the stimulus and is context dependent.

79. Gavin Hazen

Class Year: 2023
Major(s): Chemistry
Other Authors/Contributors: Yichen (Ethan) Li
Supervisor(s) and affiliation or institution: Steven Drew (Charles "Jim" and Marjorie Kade Professor of the Sciences and Chemistry, Carleton College)

Title: *Creating Cheaper Mixed Metal Oxide Films for Renewable Hydrogen Production*

Hydrogen production via water splitting reactions in a photoelectrochemical cell utilizing mixed metal oxide films has had promising results. Our research expands upon prior research on the Fe, Cr, Al oxide system, utilizing a cheaper restricted solution deposition technique to create mixed metal oxide films. We successfully created films and collected 2D photoelectrochemical data. We observed that solution deposition conditions, specifically ammonia concentration, affects the activity of the film in unexpected ways. Utilizing energy dispersive X-ray spectroscopy, we spatially analyzed the elemental composition of

our films and found that the deposited Fe-Cr-Al molar ratio varied from the expected molar ratio in relation to ammonia concentration. Hypotheses to explain this observation will be presented, as well as ideas for further experimentation.

80. Sue He

Class Year: 2022
Major(s): Computer Science, Linguistics
Other Authors/Contributors: Ruken Bastimar, Elliot Stork, Jenna Conklin
Supervisor(s) and affiliation or institution: Jenna Conklin (Visiting Assistant Professor of Linguistics, Carleton College)

Title: *Direction, Locus of Control, and Target-Trigger Distance Have Little Impact on Phonological Learning of Sibilant Harmony*
This study used artificial grammar learning to investigate whether there is a learnability bias in consonant harmony based on direction or locus of control and whether directionality or control impacts whether recognition of a consonant harmony process decays over distance. There is an asymmetry in natural languages which suggests it may be hardest to learn prefix-controlled harmony, but equally easy to learn the other three patterns.

Participants in testing groups were trained on one of the four patterns differing in directionality and control and completed a two-alternative forced-choice test. Neither Direction nor Locus of Control predicted participants' performance, indicating that all patterns are equally learnable, i.e., the asymmetry in attested language may not be caused by learnability. Furthermore, no effect of distance emerged, suggesting that distance-based effects in the production domain do not rest upon a learnability bias but may be caused by processing limitations or other online restrictions.

81. Ella Hein

Class Year: 2023
Major(s): Chemistry
Supervisor(s) and affiliation or institution: Deborah Gross (Professor of Chemistry, Carleton College)

Title: *Cooking Should Not Kill: Indoor Air Quality in Urban Ethiopian Households*
Pollution from cooking with biomass fuels kills hundreds of thousands each year, particularly women and children. This study investigated the real-time, fine particulate matter concentrations in households located in Addis Ababa, Ethiopia, where biomass is the primary source of cooking fuel. Results illustrate the hazards of burning charcoal and the improvements that can be achieved when switching to improved cookstoves.

82. Arlo Hettle

Class Year: 2022
Major(s): Political Science/International Relations

Title: *Community Organizing in Des Moines Iowa*
This summer, I interned for AMOS (A Mid-Iowa Organizing Strategy), a broad-based community organizing group affiliated with the Industrial Areas Foundation, the nation's largest network of community-based organizations. There, I learned the principles of community organizing and helped congregations and nonprofits in the Des Moines area advocate for themselves on a variety of issues, including children's mental health, affordable housing, and workforce development.

This experience was funded by: Class of 1963 50th Reunion Fund for Internships

83. Klara Heuchert

Class Year: 2022
Major(s): Environmental Studies

Title: *Animal Care Internship at the Wildlife Science Center*
I worked for thirteen weeks as an animal care intern at the Wildlife Science Center in Stacy, Minnesota, north of the Twin Cities; it is an education-centered captive animal facility that houses many different animals, though most people come to see the nearly 100 wolves. I usually fed and cleaned enclosures for animals like raccoons, porcupines, raptors, tortoises, bears, cougars, and wolves, among others. I also assisted with wolf research and care, educational tours and programs, enclosure construction, grounds maintenance, and many other diverse tasks!

This experience was funded by: Multicultural Alumni Network Fellows Program (MCAN)

84. Shakeal Hodge

Class Year: 2023
Major(s): Computer Science

Title: *Evolutionary stability of host-endosymbiont mutualism is decreased by multi-infection*
Endosymbioses (in which a symbiont lives inside a host) exist in many contexts in nature. Interactions between the host and endosymbiont exist along a spectrum from parasitism to mutualism. In mutualistic interactions, both partners benefit. In parasitic interactions, however, the endosymbiont harms the host (often by stealing resources) for its own benefit. Hosts may or may not invest resources in defending themselves from parasites. Previous research in a digital model system called Symbulation has shown that the evolutionary stability of mutualisms between hosts and endosymbionts depends on the rate of vertical transmission (symbiont offspring ending up inside host offspring), with even fairly low rates of vertical transmission being sufficient to maintain mutualism. However, this work was conducted in a scenario where only one symbiont could infect a given host at a time. Here, we investigate the impact of larger symbiont populations within a host on the relationship between vertical transmission rate and mutualism. We show that larger symbiont populations increase the vertical transmission rate needed to maintain mutualism. We hypothesize that this effect is caused by a breakdown in cooperation between the set of symbionts within the host. Investigations into whether this effect can be mitigated by adding extra incentives for cooperation among symbionts is ongoing.

This experience was funded by: Kolenkow-Reitz Fellowship

85. Maya Hofmann

Class Year: 2023
Major(s): Biology

Title: *What's Your FQI? Using Floristic Quality Indices to Foster Urban Conservation*

Floristic quality indices (FQI) are used by natural areas managers to measure conservation values of sites (Freyman 2016). We propose that these metrics can enhance urban sustainability efforts by challenging neighborhoods, parks, and campuses to compete for best floristic quality status. Natural areas/plantings that foster high native plant diversity in city environments should be encouraged given the critical role native plants and keystone genera play in supporting native animal populations. FQI and mean coefficient of conservatism metrics can provide increased community plant identification skills, greater local knowledge of native/non-native/invasive species, and more urban conservation initiatives. To pilot test this concept, we developed cumulative native plant species lists for four different Springfield, IL natural areas. We found that each of the sites are of high conservation value. Calculating conservation metrics thus creates initiative to enhance native plant and pollinator conservation in local communities.

86. Kinga Hope Csikszentmihalyi

Class Year: 2022
Major(s): Sociology/Anthropology

Title: *Comprehensive Medication Management Internship, California Department of Public Health*
Community Health Workers (CHWs) play multiple roles on a health care team to facilitate change in patients' health outcomes across the care continuum. This fact sheet focuses on two CHW roles: linking patients to health care services and linking patients to community resources. In these roles, CHWs help patients initiate behavioral changes in cardiovascular disease management by increasing awareness and use of existing health care services and community resources. With the proper training, CHWs can also link patients to resources on how to control their blood pressure, cholesterol, and blood sugar levels and resources that promote physical activity and smoking cessation as needed. CHWs can also help providers with gathering health information from the patients to determine or update their health management plan.

87. Lily Horne

Class Year: 2023
Major(s): Sociology/Anthropology

Title: *Podcast Production Intern*
My internship was with the Maine Mountain Collaborative where I worked on their podcast, which is about relationships between people and the land in Maine. I traveled around Maine, interviewing traditional guides, foresters, educators, conservationists, and other advocates for Maine's wild places. In addition to planning and conducting interviews, I also edited the audio, produced the podcast, did outreach, and marketed the podcast.

88. Becca Horwitz

Class Year: 2022
Major(s): Environmental Studies, Geology
Supervisor(s) and affiliation or institution: Miles Travis (Professor of Oceanography, Rutgers University)

Title: *Investigating the Overlap between the Mid-Atlantic Bight Cold Pool and Leased Off-Shore Wind Sites*

The Mid-Atlantic Cold Pool is a seasonal mass of cold water extending throughout the Mid-Atlantic Bight (MAB) from Massachusetts to North Carolina. The Cold Pool forms from spring warming and dissipates in the fall from mixing events. Studies in Europe demonstrate that existing offshore wind turbines lead to weakened stratification. Due to differences between European and MAB sites, it is unknown if wind development in the MAB will affect the Cold Pool. To better understand the impacts of offshore wind, I evaluated over 10 years of in situ data and output from a coastal ocean model. The goal of this study was to establish the duration and strength of the Cold Pool. Preliminary results highlight overlap between the Cold Pool and the northern six of the eight sites analyzed. Further analysis based on observational and modeled studies is necessary to determine potential interactions between offshore wind and the Cold Pool.

89. Khalid Hussain

Class Year: 2022
Major(s): Computer Science

Title: *Data for Organizing Intern at TakeAction Minnesota*

This summer, I participated in a non-profit organization called TakeAction MN, engaged in building the progressive movement in Minnesota through political organizing. I served as the "Data for Organizing Intern", a role that fuses both leadership development with the analytical skills around data collection and digital organizing. The leadership development aspect entailed developing the skills and experience of the organizers who have worked with TakeAction to spur social change. The digital organizing aspect involved both presenting and analyzing different statistics about the base that had been engaged in TakeAction's efforts over the past year, using the data that had been accumulated in their various databases. Lastly, I was also involved in various data maintenance projects with the goal of removing extraneous or duplicated data points within these databases.

90. Chiamaka Ifedi

Class Year: 2023
Major(s): Cognitive Science
Other Authors/Contributors: Katrina Sewell
Supervisor(s) and affiliation or institution: Julia Strand (Associate Professor of Psychology)

Title: *Expanding Speech Perception Research Beyond "Native English Speakers"*

Despite the fact that the goal of psychological research is gaining a better understanding of human behavior, many studies make use of samples that do not represent the human population generally. This problem is exacerbated in research on speech, where the norm is to only test "native" speakers of English. This practice is supported by evidence that native and nonnative speakers perform differently on some speech perception tasks. However, it constrains an already limited pool of participants and alienates certain groups. This study aims to assess whether and how including non-native speakers in a replication of classic findings in the speech perception literature will affect the outcomes. We will test well-established findings in spoken word recognition, sentence processing, and listening effort. Although we anticipate to replicate effects of "native language benefits," we expect the general findings will be similar whether or not non-native speakers are included in the sample.

91. Pear Intasin

Class Year: 2022
Major(s): Biology

Title: *Viral Tissue Tropism of a Picornavirus in Two Different Zebrafish Lines*
Zebrafish, highly amenable to genetic and chemical manipulations, have gained ground as a model organism for studying virus-host interactions because of their conserved antiviral response. Previously, Balla et al. (2020) discovered an endemic picornavirus (ZfPV) affecting zebrafish worldwide. Infection, while asymptomatic, triggered a strong immune response in the gut.
In this study, using immunohistochemistry, I investigated the isg15 spatial expression in infected CG2 and TU. isg15 expression is a readout for interferon signaling - a conserved vertebrate antiviral response. The results showed that upon infection, isg15 was expressed in the intestine of both infected CG2 and TU larvae suggesting strong interferon responses in the gut of both strains. In contrast, I only observed isg15 expression in the spinal cord of CG2 but not TU larvae suggesting a different immune response in neuronal cells. Further studies using genomic approaches are pivotal to understand the differences in susceptibility to the infection.

92. Shaheer Jaffar

Class Year: 2024
Major(s): Undecided

Title: *Economic opportunity Intern*
In the past summer, I had an amazing opportunity to work with the City of Northfield's Economic Department. The City of Northfield's Community Development Department launched new initiatives in 2021 to support minority-owned business development within the City of Northfield. I worked on a few projects to help advance equal economic opportunity as part of the City's initiatives. I worked with the City to research and craft new communication tools to increase the accessibility of City grant and loan programs for minority-owned businesses. Furthermore, I created a toolkit that included drafted engagement emails, scripts detailing opportunities for support and funding, and contact information for people and resources for minority-owned businesses. Overall, it was a very fun and meaningful experience.

93. Moses Jehng

Class Year: 2022
Major(s): Political Science/International Relations
Supervisor(s) and affiliation or institution: Kimberly Smith (Professor of Environmental Studies, Carleton College)

Title: *Environmental Law Centers and Policy*
The development of "centers" in American law schools is a relatively new and little-researched phenomenon, with most of these centers proliferating over the last two decades. This project focuses on environmental law centers. In addition to enhancing the academic offerings at their school, many environmental law centers seek to influence policy. To determine how and whether environmental law centers are influencing policy, this study analyzed reported activities across three centers, observing what proportion of a center's activities were policy-oriented, what kinds of approaches were taken by centers to influence policy, and specific cases where centers influenced policy. I found that policy-

oriented activities comprised a non-negligible portion of the centers' reported activities. Some centers more frequently worked directly with policymakers and others focused on reports and white papers. Centers have produced significant policy outcomes, such as preparing a city sea level rise adaptation plan, an amicus brief, and legislative changes.

94. Helen Jin-Lee

Class Year: 2023
Major(s): Chemistry
Supervisor(s) and affiliation or institution: Haidong Dong (Mayo Clinic), Xin Liu (Mayo Clinic), Whitney Barham (Mayo Clinic)

Title: *The Effects of a New Anti-PD-L1 Antibody on CD8+ T Cell Tumor Infiltration and Functionality*
The anti-PD-L1 immune checkpoint inhibitor (ICI) therapy has delivered good outcomes to many cancer patients, but many also show no response. H1A is a new anti-PD-L1 antibody developed in our lab that binds to PD-L1 but does not block the interaction between PD-1 and PD-L1, and it may be able to induce PD-L1 degradation. Interested in H1A's potential as an effective ICI therapy, we used immunofluorescence staining to observe the effect of H1A on the tumor infiltration ability of CX3CR1+ CD8+ effector T cells in an in vivo mouse model, and we used flow cytometry to measure the effect of H1A on the functionality of healthy human peripheral blood mononuclear cells (PBMCs). We found that (1) H1A had no significant effect on the tumor infiltration ability of CX3CR1+ CD8+ effector T cells, and (2) H1A may increase CD8+ T cell activation but not affect their functionality or differentiation.

95. Teagan Johnson

Class Year: 2023
Major(s): Computer Science
Supervisor(s) and affiliation or institution: Aaron Bauer (Assistant Professor of Computer Science, Carleton College)

Title: *Dragon Architect 2.0*
Over this past summer, I worked with Professor Aaron Bauer in the CS department on re-implementing an educational game designed to introduce basic computational ideas. This summer work focused on transitioning the game, Dragon Architect, to use a variety of modern web technologies such as ReactJS and Typescript. The old code for Dragon Architect, written mostly in javascript, was outdated and difficult to comprehend. Our goals for the summer were to overhaul the old javascript code and make it easier to understand. Ultimately, we made the codebase more intuitive by using ReactJS, improved the documentation of the code by adding comments to important chunks of code, and made the code more flexible to ensure ease of adding future extensions. Our improvements will contribute to Dragon Architect's mission of researching computer science education.

https://github.com/awb-carleton/dragon-architect-2

96. Julia Johnston

Class Year: 2022
Major(s): English, Psychology
Other Authors/Contributors: Bethany Lazo, Natalie Ruiz

Supervisor(s) and affiliation or institution: Neil Lutsky (William R. Kenan, Jr. Professor of Psychology, Carleton College)

Title: *Grave Regrets: The Psychology of Farewell During the COVID-19 Pandemic*
The current study investigates how people wish to say goodbye to their dying loved ones and the regrets they may have if denied that opportunity, a common situation in the COVID-19 pandemic. This study employs two different fictional scenarios, which are identical except for the sentience (responsiveness and awareness or lack thereof) of the dying loved one, and a developed questionnaire on regret. We anticipate that participants will report more regret if they perceive sentience, and we expect that participants will rate [not being able to] "touch and/or kiss your loved one" higher than items like "create a pleasant environment for your loved one". Similarly, we expect closeness to the loved one, sense of obligation, culture, and religion to be associated with higher ratings of regret items referencing these factors than regret items that do not. This exploratory study will expand upon previous regret literature on death and unfinished business.

97. Trevor Jones

Class Year: 2023
Major(s): Biology

Title: *Leveraging The Cancer Dependency Map to Predict Novel Functional Interactions in the Ubiquitin System*
The Cancer Dependency Map utilizes CRISPR-Cas9 screens to give scores for a gene's essentiality in cancer cells lines. High correlations for these scores between 2 genes across many cell lines is a sign of a potential functional interaction between those genes' proteins. By analyzing high correlates of deubiquitylating enzymes (DUBs), we developed 7 hypotheses for novel functions of these enzymes. We demonstrate how this analysis of the Cancer Dependency Map's correlations can reveal known functions of well-characterized DUBs and suggest novel functions for poorly characterized DUBs.

98. Shira Julie

Class Year: 2022
Major(s): Mathematics
Supervisor(s) and affiliation or institution: Corey Dunn (Professor of Mathematics, California State University, San Bernardino)

Title: *Linear Dependence Relationships of Canonical Algebraic Curvature Tensors as Described by Weighted Directed Graphs*
Our goal is to understand the role of kernels in linear dependence relationships between canonical algebraic curvature tensors. In this project, we study such linear dependence relationships by analyzing different types of weighted directed graphs. We present the background information necessary for motivating our work. We then state our conclusions about linear dependence with respect to the different weighted directed graphs. Lastly, we present directions for future study.

99. Simran Kadam

Class Year: 2023
Major(s): Environmental Studies

Title: *Carleton Organic Farm Student Manager*

The Carleton Student Farm is a 1.5-acre student-run farm located just north of the Carleton Recreation Center near Farm House. Each year, three new interns are chosen to plan the season, cultivate, and sell produce to the dining halls. The Carleton Student Farm Internship provides a unique opportunity to learn about sustainable farming practices by managing an organic farm on your own.

100. Nina Kaushikkar

Class Year: 2022
Major(s): English, Political Science/International Relations
Supervisor(s) and affiliation or institution: Summer Forester (Assistant Professor of Political Science, Carleton College), Arnab Chakladar (Associate Professor of English, Carleton College), Harini Kumar (University of Chicago)

Title: *A Feminist Transitional Justice: Jineology in Syrian Conflict Resolution*
The exclusion of women from transitional justice processes at the local and international level has led to prolonged gender-based violence and greater levels of post-conflict societal instability. As a result, a feminist approach to shaping transitional justice institutions in the form of restorative justice projects ought to be prioritized. I turn to the Kurdish feminist framework of Jineology to examine its impact on Syrian transitional justice mechanisms, focusing on how the narrative practices embedded in Jineological legal institutions can provide a template for future restorative transitional justice projects. I rely on previously published interviews with local experts, activists, and community members, as well as reports and online news sources, to better understand how narrative can be uniquely incorporated into Syrian transitional justice measures. Ultimately, this work will provide a useful addition towards constructing gender-sensitive and equitable transitional justice processes, leading to a more stable post-conflict society.

101. Ally Keen

Class Year: 2022
Major(s): Physics
Supervisor(s) and affiliation or institution: Ryan Terrien (Assistant Professor of Physics and Astronomy, Carleton College)

Title: *Correcting Telluric Absorption Lines with TelFit*
Ground-based stellar spectroscopy introduces telluric absorption lines, features characteristic to Earth's atmosphere that appear in the observed spectra and often obscure wavelength regions important for analysis. A common correction method uses a synthetic transmission spectrum to remove telluric features. We apply TelFit, a Python code that generates a model telluric spectrum based on a line list and atmospheric observing conditions, to Habitable Zone Planet Finder (HPF) spectra, correcting in near-infrared regions with prominent water and oxygen contamination. When applied to near featureless early-type stars, we demonstrate a correction level within 1% of the continuum. For late M dwarf spectra, we investigate the impact of atmosphere profiles and optimize fitting regions by discerning between stellar and telluric absorption features. Though further improved fits are required for M dwarf spectra, implementing TelFit would allow extraction of valuable wavelength regions, such as those with magnetically insensitive absorption lines.

102. Riaz Kelly

Class Year: 2024
Major(s): Undecided

Title: *Animal Guessing Game at SayKid*
SayKid is a company whose product is a plush robot with an Amazon Alexa device inside. The robot is designed to help kids learn speech, play educational games with them, and help kids build conversational skills. I built a game in which the kid thinks of an animal and the robot will play a 20 question style game to guess the animal. I used a software called Voiceflow, which is a helpful interface for building Alexa–based software. I first completed a google spreadsheet database of around 150 of the most popular animals and came up with yes or no questions and answers for each animal. I considered multiple design options and eventually chose a dynamic style that would vary questions more, utilize animal sound effects, and engage kids better than a fixed model in which you would be asked the same questions every time you picked a given animal.

103. Miah Kline

Class Year: 2022
Major(s): Chemistry

Title: *Hyperglycemia Induced Endoplasmic Reticulum Stress in Cardiomyocytes*
Hyperglycemia is a condition in the body where there are high levels of blood glucose, which, when sustained, leads to diabetes. Long-term uncontrolled or poorly managed diabetes can lead to diabetic complications in the heart, namely, cardiomyopathy. This study looked at the expression of specific proteins in the endoplasmic reticulum (ER) that are part of the Unfolded Protein Response (UPR) in cardiomyocytes. When exposed to hyperglycemic conditions overnight, the UPR transmembrane proteins IRE1, PERK, and BiP had increased expression. There was also an increase in the phosphorylation states of JNK, PERK, and EIF2a in cardiomyocytes exposed to high glucose for 60 minutes. In addition, cardiomyocytes exposed to hyperglycemic conditions overnight showed an increase in the expression of CHOP and chaperone proteins HSP60 and HSP70. The results support the study's hypothesis that hyperglycemic exposure increases oxidative stress leading to ER stress in cardiomyocytes.

104. Elise Knutsen

Class Year: 2023
Major(s): Physics
Other Authors/Contributors: Evan Arch, Logan Plasch, Kevin Clelland
Supervisor(s) and affiliation or institution: Barry Costanzi (Assistant Professor of Physics, Carleton College)

Title: *Simulation of Magnetic Configurations In Mesoscale Permalloy Dots*
The magnetic behavior of electrons can be clearly modeled at extreme length scales. However, at sizes in the hundreds of nanometers, the mesoscale, the behavior is difficult to predict due to the competition between the classical magnetostatic forces and the quantum exchange forces. Due to the large number of interacting spins, these systems can not be easily modeled analytically, necessitating a numeric technique. We use Mumax3 micromagnetic simulation to determine the magnetic states of square permalloy ($Ni80Fe20$) dots that are 100's of nm on a side. Understanding magnetic materials at

this scale is critical for the future development of spintronic devices and to understanding the fundamental physics of middle-scale systems which are neither strictly classical nor quantum.

105. Logan Knutson

Class Year: 2022
Major(s): Political Science/International Relations

Title: *Summer Intern - Criminal Defense Paralegal*
Working full time for 8 weeks, I interned at Keller Law Offices (KLO), a Minneapolis-based private criminal defense firm. My responsibilities ranged from conducting legal research and analysis, to writing petitions so clients could expunge their criminal records or reclaim their forfeited vehicles. The tangible and immediate impact my work had on the office and on the lives of Max Keller's clients motivates me to continue pursuing law. Not only did my internship grant me the opportunity to quickly develop legal writing skills and garner familiarity with the profession, but it helped me narrow my interest to criminal law specifically. For the beginning of my career, I can easily see myself doing the same work I learned from Max this summer.

106. Evie Kortanek

Class Year: 2022
Major(s): Psychology
Other Authors/Contributors: Luis Alvarez, Lydia Boyum, and Shannon Liu
Supervisor(s) and affiliation or institution: Julie Neiworth (Laurence McKinley Gould Professor of the Natural Sciences and Psychology, Carleton College)

Title: *Neural Mechanisms of Aging and Cognitive Decline: Tamarins as a Model of Human Aging and Alzheimer's Disease*
Broadly, we aim to investigate the relationships among different styles of cognitive decline and the presence of neuropathological markers of Alzheimer's Disease (AD) in cotton-top tamarins (Saguinus oedipus). The tasks selected show marked differences in elderly human patients with AD as opposed to age-matched cohorts. Specifically, limited visuospatial attention, rapid forgetting of working memory, and difficulty in shifting rules are signature failures that are used to diagnose AD in humans. Tamarins accumulate beta amyloid plaques, reactive astrocytes, activated microglia, and neural loss with aging (Lemere, 2008). There is evidence of tau species in the intracellular and extracellular space (Lemere, 2008; Neiworth et al., present). We ask whether estimated levels of these neuropathological markers in cotton-top tamarins post mortem correlate cognitive losses. Through modeling, we can find the best fit to explain the ordered contributions of immune reactions and protein aberrations to the decline observed in life.

107. Alec Kotler

Class Year: 2022
Major(s): Biology
Supervisor(s) and affiliation or institution: Gregory Ducker (Professor of Biochemistry, University of Utah)

Title: *The Effects of Asparagine Synthetase on Cellular Metabolism across Leukemia and Liver Cancer Cells*

Cancer cells consume nutrients at high rates to sustain rapid proliferation, which can make them vulnerable to nutrient limitations in the tumor microenvironment. At the same time however, many tumor cells downregulate non-essential metabolic enzymes in order to streamline their metabolism leading to a heightened reliance on extracellular nutrients. Asparagine synthetase (ASNS) is an enzyme that is often downregulated in different types of cancer leading to a dependence on asparagine. To explore how loss of ASNS rewires cellular metabolism, and if new vulnerabilities result from this, we used CRISPR screens to identify the aspartate utilizing enzymes ASS1 and CAD as synthetically lethal in ASNS-deficient leukemia cells. We next sought to expand this observation into ASNS-deficient liver cancer cells. Using q-RT-PCR, we measured the expression of genes related to asparagine and aspartate metabolism. In ASNS knockout (KO) leukemia cell lines, the arginine synthesis gene ASS1, and its transcriptional regulator, c-MYC, are decreased compared to wild type. In addition, aspartate transporter (SLC1A3) and complex I members (NDUFA6/7) are increased. Mass spectrometry data corroborates this finding by confirming that arginine levels and NAD+ levels are increased. This result suggests an increase in arginine transport and shift towards glycolysis. These findings indicate the rewiring of ASNS deficient cells contribute to continued cell growth but also highlights vulnerabilities in these cells that can be targeted in the making of future therapeutics.

108. Amy Kropp

Class Year: 2022
Major(s): Political Science/International Relations

Title: *Examining the Feasibility of Adding a Facility Dog to the Rice County Attorney's Office*

Facility dogs are professionally trained dogs that often work in attorney's offices and courthouses. Believet™, a Northfield-based service dog training organization, and the Rice County Attorney's Office have been discussing the possibility of training and introducing a facility dog to Rice County. This report examines the scientific and anecdotal evidence supporting facility dogs and discusses what steps need to be taken in order to successfully introduce a dog into an office or public setting. This report also looks at the current state of laws about facility dogs and what is needed to take a dog into court in Minnesota.

109. Bethany Lazo

Class Year: 2022
Major(s): Psychology

Title: *Science Writing at Concussion Alliance*

Concussion Alliance is a non-profit organization designed to provide concussion patients with science-based resources to aid in their recovery and help them understand their symptoms. The science writing position requires interns to create a page on the organization's website focused on a concussion treatment or symptom. My project addresses sleep disturbances post-concussion, as physicians often underestimate the impact of these problems on recovery and wellbeing. The webpage first discusses how mild traumatic brain injury (mTBI) can disrupt sleep and extend recovery time. It ends with tips for improving sleep hygiene and finding a provider to treat concussion-related sleep disorders.

110. Siena Leone-Getten

Class Year: 2022
Major(s): American Studies

Title: *MN350 Communications Internship - Andersen Foundation Fellowship*
The Andersen Foundation "promotes a rich understanding of our national life through the study of our institutions, our histories, and our communities." MN350 (and its 501(c)(4) wing, MN350 Action) is an environmental justice organization working to "end the pollution damaging our climate, speed the transition to clean energy, and create a just and healthy future for all." My internship at MN350 fulfilled the mission of the Anderson Foundation because they center an understanding that the fight against climate change requires that Minnesotans unite across race, class and geography and center the leadership of frontline communities to dismantle intertwined systems of oppression.

This experience was funded by: American Studies - Anderson Fellowship Internship Funding

111. Carly Lo

Class Year: 2022
Major(s): Biology
Supervisor(s) and affiliation or institution: Richard K. Grosberg (Distinguished Professor, University of California, Davis), Rachael Bay (Associate Professor, University of California, Davis)

Title: *Impact of Temperature on Vertical and Latitudinal Ranges of Four Barnacle Species Along the California Coast*
Temperature is an important driver of species distribution in the intertidal zone. Previous studies have found that biological and ecological responses of marine organisms to warming oceans include poleward distribution shifts, but little is known about how temperature affects vertical zonation. We examined the effects of increased temperatures on latitudinal and vertical ranges of Balanus, Chthamalus, Pollicipes polymerus, and Tetraclita rubescens, hypothesizing that as temperature increases, there will be larger abundances northwards and lower in the intertidal zone. We performed linear correlations from data obtained through NOAA and MARINe, and found that there is no overall correlation between percent cover or rock height and temperature but site-specific correlations at Paradise Cove for Balanus and Bird Rock for Tetraclita. Thus, it is likely that our species are not shifting their ranges vertically, though future studies could examine a larger range of sites and years, and use more accurate temperature measurements.

112. Naomi Lopez

Class Year: 2022
Major(s): Political Science/International Relations

Title: *Children of Incarcerated Caregivers*
This is my second year working with CIC, and I was excited to reunite with my supervisor and the other CIC interns. Returning to my role as the Community Outreach Coordinator, I was given several goals. First and foremost, I needed to recruit families that had been impacted by incarceration for our annual sleep-away camp and bike camp. I exceeded our goal for enrollment by reaching out to hundreds of community groups, social workers, and legal professionals. I also became more involved in the operations of the non-profit this year. I connected with several nonprofits in Minneapolis to build our network, supplemented resources on our website, and learned about the day-to-day operations of a non-profit

This experience was funded by: Multicultural Alumni Network Fellows Program (MCAN)

113. Jadie Luo

Class Year: 2022
Major(s): Political Science/International Relations

Title: *Programming Intercultural Conversations at the Hong Kong International Literary Festival*
This summer, I had the opportunity to work at the Hong Kong International Literary Festival. The Festival is a non-profit that hosts a variety of literary events each year with the vision of building a better society by facilitating meaningful conversations between writers and book lovers. I was mainly responsible for managing and promoting our events both on and offline.

This experience was funded by: Donald A. Camp '70 and Elizabeth Hart Camp Endowed Internship Fund

114. Sophia Maag

Class Year: 2023
Major(s): Sociology/Anthropology

Title: *Understanding Healthy Masculinity and Work Culture with Maine Boys to Men*
My summer internship consisted of educating myself on ideas of healthy masculinity and gender identity while aiding Maine Boys to Men with their youth podcast. I learned to edit audio and I spent a lot of time brainstorming ideas for future episodes. All the while I was immersed in a company culture that worked hard but was also exceedingly aware of the needs of their employees.

This experience was funded by: Jean Phillips Memorial Internship Fund

115. Manjari Majumdar

Class Year: 2022
Major(s): Cinema and Media Studies, Political Science/International Relations

Title: *Institution-Based Organizing in Portland, OR*
This past summer, myself and two other Carleton students interned at Industrial Areas Foundation Northwest in Portland, OR under supervision of a '78 Alum and former Wellstone student. My key roles were conducting 1:1 relational interviews with community members and potential allies, as well as doing research and power analyses on different ongoing social justice issues in the Portland area.

This experience was funded by: Social Justice Internships funds from the Chaplain's office

116. Astrid Malter

Class Year: 2023
Major(s): Cinema and Media Studies

Title: *Rooftop Films Summer Internship*
This summer I interned with a local, nonprofit film festival that focuses on independent cinema. As a general intern, I worked with the communications, marketing, event planning and programming teams, allowing me to gain an understanding of the entire organization and begin to see what type of work I would like to do more of in the future. This internship reaffirmed my decision to major in Cinema & Media Studies and I am thankful for what I learned from my creative and hardworking supervisors, who were so generous with their time and knowledge.

This experience was funded by: Student Internships Endowed Fund

117. Jeep Maneenoi

Class Year: 2022
Major(s): Studio Art, Geology
Supervisor(s) and affiliation or institution: Raphael Bissen (Department of Mining and Petroleum Engineering, Faculty of Engineering, Chulalongkorn University, Thailand)

Title: ***The Influence on the Expansion Rate of Soundless Cracking Demolition Agents (SCDAs) By Different Concentration of Chemical Accelerators and Viscosity Enhancing Agents (VEAs)***
Soundless Cracking Demolition Agents (SCDAs) are an environmental-friendly and safer alternative to the traditional methods used in rock fragmentation. However, their applicability is limited in the mining industry by its delayed performance of expansive pressure. This limitation can be alleviated by introducing chemical accelerators ($NaCl$, $MgCl_2$, and $CaCl_2$) and Viscosity Enhancing Agents (VEAs) to modify the SCDA system. This study investigates the effects of different concentrations of chemical accelerators and VEAs on the SCDA demolition performance. The modified SCDA mixtures were characterized by observing and recording when the first crack appeared on the surface of the Portland Type 1 Cement Blocks. Flowability tests were also performed to determine the workability in the field application.

As a result, the increased addition of $MgCl_2$ and $CaCl_2$ significantly accelerated the expansive pressure rate. The addition of VEAs alone retarded the SCDA reaction rate, however, when combined with chemical accelerators, both additives improve the fracturing performance. The study proposes an optimum combination of VEA (Xanthan gum, 0.2 wt%) and the chemical accelerator ($MgCl_2$, 4 wt%) to significantly enhance the demolition performance of the SCDA system.

118. Thandie Mangena

Class Year: 2022
Major(s): Biology

Title: ***Enhancement of type 1 interferon induction with drug and radiation treatments to increase anti-tumor immunity***
Accumulating evidence indicates that the efficacy of a variety of cancer treatments, including radiation, relies on type 1 interferon signaling. Various researchers have shown that some anti-tumor effects are lost with IFNAR1 (interferon receptor) neutralizing monoclonal antibodies in various cancer types after treatment. Research shows that radiotherapy, in a type 1 IFN-dependent manner, promotes innate immune responses that support an adaptive immune response and antitumor immunity. However, direct administration of interferon to patients has major adverse outcomes due to inflammation. While the intracellular DNA sensing pathway mediated by cGAS-STING has been shown to induce IFN production, other pathways are being discovered and targeted to improve RT (radiotherapy) efficacy. 2 drugs involved in the circadian rhythm and immunity were tested for increase in IFN1 production with radiation. The success of these drugs implies a possible link between time of radiation and drug delivery and efficacy of treatment.

119. Aidan Martin

Class Year: 2023
Major(s): Psychology
Supervisor(s) and affiliation or institution: Tommy Navis and Matt Lattal (Oregon Health & Science University)
Title: ***Exploring the Neuropathology Of PTSD***

Substance abuse disorders are often comorbid with post traumatic stress disorder (PTSD). Previous work shows that repeated foot shocks given to rats cause them to respond constantly to a methamphetamine-paired stimulus (Pizzimeti, Navis, & Lattal 2017). This shock experience also causes a persistent sensitized stress response which models PTSD (as shown by enhanced freezing behavior in a new context separate from the original meth infusion context, called stress enhanced fear learning (SEFL - Fig.1).

The Amygdala is responsible for both the constant response to a meth-paired cue (Meil & See, 1997) and the SFEL effect (Perusini et al. 2015), possibly do to neural activity in that region during a traumatic event (foot shocks). The aim of this study was to determine if Amygdala function at the time of a series of foot shocks is responsible for both the constant response to a meth-paired cue and the SEFL effect.

120. [Redacted] Maxwell

Class Year: 2023
Major(s): Religion

Title: *Internship With Yes4Minneapolis*
I worked with the Yes4Minneapolis campaign, a campaign based around a ballot initiative to replace the Minneapolis Police Department with a Department of Public Safety. As the comms intern, I did writing for the campaign, moderated social media, and worked at events including Pride and the public coalition launch.

121. James McGehee

Class Year: 2022
Major(s): Geology
Supervisor(s) and affiliation or institution: Cameron Davidson (Charles L. Denison Professor of Geology, Carleton College)

Title: *U/Pb Detrital Zircon Provenance of the Chugach-Prince William Terrane, Baranof Island, SE Alaska*
The Chugach-Prince William terrane (CPW) is a ~2200 km accretionary complex that runs along the southern continental margin of Alaska. It is primarily composed of turbidites, which contain detrital zircons that can be dated using U/Pb geochronology. These dates can be used to calculate the maximum depositional ages (MDA) of samples, which are useful in understanding the timeline and accumulation history of the CPW. Additionally, detrital zircon ages are used as indices of provenance, which can be vital for understanding tectonic plate displacement history. Eight samples of graywacke and meta-graywacke were collected from sites on Baranof Island along Sitka Sound and Whale Bay, SE Alaska. This study presents new U/Pb ages collected from detrital zircons contained in these rocks. MDAs were largely consistent with the continuous inboard-to-outboard younging age progression model proposed by Rick (2014). Furthermore, the MDAs were consistent with the ages of the three geographic belts also proposed by Rick (2014), with the exception of three Sitka Graywacke samples in the Albian Belt that had Coniacian-Santonian MDAs. Although these data do not fit neatly into the Rick (2014) belt model, they do support the claim that there was continuous accretion of the CPW in this region through time. These preliminary data suggest that a fourth belt may exist in the younging inboard to outboard sequence: an intermediate Cenomanian-Santonian belt deposited 84-100 Ma.

122. Ton Meesena

Class Year: 2023
Major(s): Mathematics

Title: *Minimizing Age of Information in Uplink Networks with Processing Constraints*
We modeled uplink wireless networks with processing time constraints. Then, we developed scheduling policies aiming to minimize WeightedSum Age of Information (WSAoI), a measurement of processed information's freshness. We created two low-complexity, cyclic scheduling policies, and another two heuristic scheduling policies. Then, we simulated the performance of these four policies numerically on Python and showed that both heuristic scheduling policies perform near-optimal. Furthermore, we proved that for any network setup, these policies are always 2-optimal.

123. Elie Mer
Class Year: 2022
Major(s): Chemistry

Title: *Processing X-ray Free-Electron Laser (XFEL) Data for Protein X-ray Crystallography*
Serial femtosecond X-ray crystallography (SFX) is an emerging technique for studying the three-dimensional (3D) structures of large biological molecules like proteins. Unlike traditional X-ray diffraction methods with an X-ray beam at a synchrotron, SFX uses an X-ray free-electron laser (XFEL). The use of an XFEL has allowed for reduced radiation damage to the sample consisting of thousands of tiny crystals, different from a single large crystal used for standard X-ray crystallography. SFX is also ideal for studying motions in proteins that are important for function. The focus of this project was on a new approach for collecting and analyzing XFEL data. A Python script was developed to process diffraction data collected on a protein using a novel microfluidic chip technology designed as a crystallization platform and data collection support for XFEL and synchrotron-based experiments. A protein 3D structure was then determined to start evaluating this chip technology for structural biology.

124. Sidra Michael

Class Year: 2023
Major(s): Art History

Title: *The Black Arts Movement in 1960s and '70s Chicago*
This project was the first research phase of a multi-year research project for the Mellon Mays Undergraduate Fellowship. My research project is investigating the relationship between Black Liberation movements and the visual arts. During this first research phase, Chicago's Black Arts Movement was studied to unearth its correlation with the Black Power Movement, which was taking place during the same period. By reading scholarship on the Black Power and Black Arts Movements, I identified the artistic conventions, ideals, and principles that emerged, along with the broader ideological and social framework of the movements. Moving out from this foundation, I will proceed to research and compare the art of the Black Arts Movement with the art of the contemporary Black Lives Matter Movement. Ultimately, my project has the goal of drawing conclusions about the role of art within specifically Black Liberation movements.

124.5 Colleen Milligan

Class Year: 2022
Major(s): Biology
Other Authors/Contributors: Aya Klos, Wanying Na, Will Walsh, Mark McKone
Supervisor(s) and affiliation or institution: Mark McKone (Professor of Biology, Carleton College)

Title: *Why so late? Flowering phenology and pollination activity in four species of late-flowering asters (Symphyotrichum)*
North American asters (Symphyotrichum spp.) are among the latest species to flower in the season. We investigated the hypothesis that late flowering allows asters to escape competition with other flowering plant species. Flowering curves were determined for four aster species in the Carleton Arboretum by periodic marking of individual flower heads. Pollinator visitation rates were observed during field surveys on 10, 22, and 29 September. Floral visitation was dominated by honeybees (Apis mellifera); multiple species of native flies and bees were also common. Total insect visitation rates did not change across the sample dates, contrary to the hypothesis that rates would increase as the season progressed. However, the relative frequency of different pollinator species changed over time. Thus there was no general trend in pollinator visitation rate that would apply to all aster species.

125. Arya Misra

Class Year: 2022
Major(s): Cinema and Media Studies
Supervisor(s) and affiliation or institution: Stacy Beckwith (Professor of Hebrew and Judaic Studies, Carleton College)

Title: *Convivencia Triumphant in La Catedral del Mar on TV/ Netflix*
This summer I had the privilege of working with Professor Beckwith investigating the history and the cinematic portrayal of Jewish-Muslim-Christian interactions in 14th century Spain. The Netflix show we focused on called, La catedral del mar (Cathedral of the Sea), is an eight-part series that is based on a best-selling novel of the same name by a very popular historical fiction writer, Ildefonso Falcones. Our research focused on the mise-en-scene and formal analysis of the show combined with in-depth historical investigation of inter-communal relations in medieval Spain. Our approach revealed disparities between Spain's historical treatment of medieval Iberian Jews and Muslims, and how they appeared and interacted on screen for 21st century audiences. We also studied how SVODs (Subscription video on demand), such as Netflix have broken into global national cinemas like Spain's, enabling some distortions of the country's multicultural past.

126. Arya Misra

Class Year: 2022
Major(s): Cinema and Media Studies

Title: *Original Programming at HBO*
This summer I had the privilege of working in the Original Programming Department at HBO. My job mostly consisted of reading scripts that were submitted to HBO to be considered for production. I would analyze the script and write a critical commentary on the content, give my insights on the target audience and budget expectations of the script and then convene with the producers and discuss what

makes the script unique and whether or not to produce it. It was a thrilling experience to intimately look into the content creation of SVODs and the race between these platforms to set themselves apart in the competition. It was also exciting to gain such a unique insight into the internal working of a multinational media giant like HBO.

127. Suad Mohamed

Class Year: 2023
Major(s): Biology

Title: *Glycolysis Increases Multivesicular Bodies in Hepatic Stellate Cells*
The aim of this study is to further understand the role of glycolysis in the secretion of fibrogenic extracellular vesicles by examining if the blocking of glycolysis using 2DG has any effect on the levels of multivesicular bodies(MVBs) in hepatic stellate cells(HSCs). We utilized immunofluorescence on HSCs to analyze if blocking glycolysis will lead to differences in the levels of the protein CD63, a marker of MVBs, and of HK2, a key phosphorylating protein in glycolysis.

128. Ayaka Moriyama

Class Year: 2022
Major(s): Dance, Physics
Supervisor(s) and affiliation or institution: Erich Runge (Professor of FG Theoretische Physik I, TU Ilmenau), Sebastian Bohm (FG Theoretische Physik I, TU Ilmenau)

Title: *Electrowetting Pump on a Chip (E-PunCh) Project – Experimental Characterization of Efficient Tesla Valves*
Using Electrowetting-On-Dielectrics (EWOD) effect and passive Tesla valves, it is possible to fabricate a micropump that does not have any moving components. Due to the normally low flow rates in microfluidic systems and in the case of the E-PunCh micropump, highly efficient valve designs are required. Diodicity, the ratio of pressure drop between the forward and backward direction of the fluid flow, indicates the efficiency of Tesla valves. A large diodicity characterizes an efficient valve design. While there are not many studies on the diodicities for small flow rates, our optimized Tesla valves achieved a maximum diodicity of around 1.8 at a Reynolds number < 40. The poster presents simulated and experimental results of the diodicity of three different valve designs. A good agreement between simulations and measurements proves that topological optimization run by COMSOL Multiphysics® is a useful tool for finding an optimized geometry.

129. Anwesha Mukherji

Class Year: 2023
Major(s): Biology, Mathematics

Title: *Murphy Avenue Pet Clinic: Veterinary Internship*
Murphy Avenue Pet Clinic is a small animal clinic located in Sunnyvale, California. During my internship, I rotated through the three staffing roles at the clinic: reception, veterinary technician, and veterinarian. I gained knowledge about diseases and injuries that commonly occur in canines and felines and how they are diagnosed. Moreover, I witnessed the compassion, teamwork, and mental strength required to work in a veterinary clinic.

130. Libby Nachreiner

Class Year: 2022
Major(s): Statistics
Other Authors/Contributors: JoJo Zhang '23, Political Science/French and Francophone Studies

Title: *Nelson for WI Campaign Internship*
The Nelson for Wisconsin campaign internship provided us with a variety of learning opportunities within the world of politics. Our work furthered efforts to elect Tom Nelson (Carleton '98) as the next Democratic U.S. Senator out of Wisconsin. In preparation for the upcoming Democratic primary, we completed several projects ranging from data and financial analyses to research to policy write-ups. Working with a top-tier, progressive candidate allowed for exposure to a myriad of valuable hands-on experiences related to political campaigning.

131. Jordan Navarro

Class Year: 2022
Major(s): Cognitive Science, Philosophy
Supervisor(s) and affiliation or institution: William Hedgcock (Associate Professor of Marketing, University of Minnesota Twin Cities)

Title: *Effects of Preview Advertisements on Attitudes About Full-Length Advertisements*
Advertisements may elicit negative responses if they are surprising, especially if they are interruptive of a desired experience. In this experiment, individuals were asked to watch a series of short documentaries to assess their attitudes about advertisements and products. Individuals were either presented with a soundcheck video consisting of a few sound bites at the beginning of the experiment or presented with this and an additional preview of an advertisement that would appear sometime later in the experiment. We predicted that individuals who were shown the preview advertisement would be less surprised by the full-length advertisement and have a more positive attitude about it and the product itself. The results of this experiment supported these predictions. The preview advertisement reduced surprise, and surprise negatively affected advertisement and product attitudes via interruption perception.

https://vimeo.com/582166261

132. Chi Nguyen

Class Year: 2022
Major(s): Chemistry, Mathematics
Supervisor(s) and affiliation or institution: Victor H. Moll (Tulane University in association with the Polymath Jr. Program)

Title: *Evaluating the Integrals of Grashteyn and Ryzhik*
The work done in this research aims to evaluate, verify and correct when necessary, all the entries in the Table of Integrals, Series and Products, also known as Grashteyn and Ryzhik.

133. Katherine Nowak

Class Year: 2022
Major(s): Biology
Supervisor(s) and affiliation or institution: Allison Dyevoich (University of Texas MD Anderson Cancer Center), Stephanie Watowich (University of Texas MD Anderson Cancer Center)

Title: *Effects of Different TLR Agonists on in vivo cDC1 and in vivo cDC2 Activation*
Mature dendritic cells (DCs) are critical to the immune system's response to foreign pathogens. Toll-like receptors (TLRs) promote the activation of type 1 and type 2 conventional dendritic cells (cDC1s and cDC2s, respectively), which contribute to anti-tumor immunity by presenting tumor antigens to lymphocytes. Conventionally, cDC1s respond to TLR3 stimulation and cDC2s respond to TLR7/8 stimulation. It is unknown whether these DC subtypes can be activated by unconventional TLR stimulation. We generated cDC1s and cDC2s in vivo, and stimulated them with Poly I:C, a TLR3 agonist, Imiquimod, a TLR7/8 agonist, or a combination treatment of both agonists. DC activation was measured through the expression of different maturation makers. Activation was highest 24 hours post-

stimulation, and the combination treatment did not cause significant increases in activation compared to individual agonist treatment. Thus, cDC1 activation is highest with conventional TLR3 stimulation and cDC2 activation is highest with conventional TLR7/8 stimulation.

134. Kenyon Nystrom

Class Year: 2022
Major(s): Computer Science

Title: *Analysis of Viral Composition at the Lost City Hydrothermal Vent Field Using Modern 'Omics' Pipelines*
Hydrothermal vent fields provide a unique habitat for microbial diversity in the deep ocean, which in turn presents an environment of distinctive conditions and hosts for viruses. Despite much recent investigation of viruses in these contexts, the understanding of their presence and characteristics in such circumstances is far from comprehensive. Here, we rigorously examine sequenced samples from various chimneys in the Lost City field using a plethora of established 'omics' techniques, along existing viral analysis pipelines and otherwise. Resulting data suggest differences in viral abundance between chimneys of differing features, as well as noteworthy patterns in putative gene functions possessed by viruses in the samples. Utilizing several complete viral genomes constructed from the metagenome, we intend to further analyze gene composition and auxiliary metabolic genes.

135. Katy Oda

Class Year: 2022
Major(s): Physics
Supervisor(s) and affiliation or institution: Ryan Terrien (Assistant Professor of Physics and Astronomy, Carleton College)

Title: *Exploring the Distribution of Nearby M Dwarfs in the Context of the Habitable Zone Planet Finder*
M dwarf stars are excellent candidates for hosting planets that might sustain life, and are also the most common in the galaxy. The Habitable Zone Planet Finder spectrograph (HPF) looks for such planets using

doppler spectroscopy. In order to interpret planet detection results from HPF, we must understand the biases (with regard to effective temperature, metallicity, etc.) of its target sample. To characterize these biases, we cross-match several newly-available large star catalogs, calculating stellar parameters for each target when possible using photometric methods. We compare the HPF survey sample with this broader population, finding potential targets to add to the survey. Work is ongoing to determine if there are unexpected discrepancies between the distributions, and the collated catalog is a useful tool for this continued investigation as well as a source of comparison values that can be used when testing new methods of calculating stellar parameters.

136. Frances O'Grady

Class Year: 2024
Major(s): Undecided

Title: *GrowingChange: Flip the Prison*
This summer I worked at GrowingChange, a 501c-3 in Wagram, North Carolina. GrowingChange is working to reclaim the former Scotland County Correctional Center (SCCC) while developing an open-source model that other organizations can use on the 300+ defunct prison sites around the United States. The organization's mission includes addressing rural poverty, the carceral cycle, and lack of rural non-commercial community spaces. The founder, and my boss, Noran Sanford hires at-risk youth to work on the site. The adolescent boys participate in a democratic process which I joined, voting on new projects, and exercising our problem-solving skills on site projects.

137. Chisom Oguh

Class Year: 2023
Major(s): Computer Science
Other Authors/Contributors: Henrie Friesen, Emma Roskopf
Supervisor(s) and affiliation or institution: Amy Csizmar Dalal (Professor of Computer Science, Carleton College)

Title: *Decoding Tech Support: Expertise Identification From a Tech Support Dataset*
Understanding human-computer interaction has the potential to greatly improve the tech help experience for users. This project utilized Natural Language Processing (NLP) and Machine Learning (ML) to analyze the Carleton ITS HelpDesk tickets for expertise and confidence while minimizing gender bias. In particular, we explored neural networks and gender-swapping as a form of data augmentation. Our preliminary results are promising and we are excited to continue exploring these avenues to improve the tech support experience.

138. Win Wen Ooi

Class Year: 2022
Major(s): Sociology/Anthropology

Title: *Markets, Chickens, and Hungry Ghosts: Cultural Heritage in the Age of COVID-19 in Penang, Malaysia*

This project explores the implications of COVID-19 on cultural heritage related to public wet markets in Penang, Malaysia through two cases: 1) a recent state-led initiative aimed to further regulate markets on the Penang island through the centralization of poultry slaughtering and distribution, and 2) the communal tradition of Hungry Ghosts Festival among the Malaysian Chinese. Case 1 primarily takes the approach of qualitative content analysis of multi-language news articles to understand the negotiation of interests among various public and private stakeholders involved. Case 2 uses ethnographic evidence to explore how festival organizers at Chowrasta Market construct the meaning of the tradition and the pandemic's impact on that. Both cases raise larger questions about the notion of cultural heritage sustainability, the interactions between political structures and culture as a way of life, and the complex ways in which individuals and groups enact agency.

139. Sade Orepo-Orjay

Class Year: 2022
Major(s): Cinema and Media Studies

Title: *Hallelujah Nation Productions*
This summer, I had the privilege and interning at a small film production company in Pasadena, California. I took on the position as a Producer's assistant and I worked in two places--the office and on set. In the office, I did administrative work like making call sheets for feature films or calling different companies to ask questions that we had about the film, and etc. During the set, I ran around and did errands for the director and producer and helped move heavy equipment.

140. Mark Paine

Class Year: 2022
Major(s): Biology
Supervisor(s) and affiliation or institution: Miguel Pereira (University of Utah), Wesley Sundquist (University of Utah)

Title: *Purification and Quantification of HIV Genomic RNA*
Quantifying HIV viral RNA is an important step in determining the in vitro efficiency of endogenous reverse transcription reactions in the HIV virus (which convert RNA to cDNA during reproduction), but current methods used in the Sundquist Lab at the University of Utah look at the concentration of the capsid protein in inactive virions, rather than taking a direct measurement of the target RNA. Finding a more direct way to quantify this RNA would be beneficial for a variety of the lab's future projects, producing more accurate results from the beginning of each experiment. This summer, I researched the efficacy of using quantitative reverse transcription PCR (RT-qPCR) to take these qualitative measurements of HIV genomic RNA, making progress toward a new, standard method of quantification. I found which reagents used in the purification and isolation of the genomic RNA have the most significant impact on the readings generated by RT-qPCR.

141. Kanishk Pandey

Class Year: 2023
Major(s): Computer Science, Physics

Supervisor(s) and affiliation or institution: Chris West (Visiting Assistant Professor of Physics and Astronomy, Macalester College)

Title: *Galactic Isotopic Decomposition for the Sculptor Dwarf Spheroidal Galaxy*
Stellar evolution models require isotopic abundance sets as input, but these abundances are incomplete outside the solar neighborhood, are challenging to infer from observations, and are galaxy specific. We present an isotopic history model for the Sculptor dwarf spheroidal galaxy based on astrophysical processes. We approximated the isotopic composition of Sculptor's late stage evolution using the OMEGA chemical evolution code and used Big Bang Nucleosynthesis predictions as the other boundary condition. We scaled isotopic abundances from late stage evolution to BBN values according to astrophysical processes responsible for their production. We summed isotopic abundances into elemental abundances and fit to observational Sculptor abundance data to tune the free parameters. We find that Type Ia SNe contribute approximately 86% to the late stage evolution Fe abundance, and neutron star mergers contribute approximately 30% to the late stage evolution Eu abundance, suggesting that CCSNe are the dominant r-process progenitors in dSphs.

https://arxiv.org/abs/2102.02790

142. Astrid Petropoulos

Class Year: 2023
Major(s): Biology
Supervisor(s) and affiliation or institution: Catherine L. Reed (McElwee Family Professor of Psychology and George R. Roberts Fellow, Claremont McKenna)

Title: *Effects of Age are Not Uniform Across Cognitive Processes: A Repeated-measures ERP Study*
Does aging affect neural processing similarly across cognitive tasks or does it target specific cognitive processing mechanisms? Frequent findings of increased latency and reduced amplitude in older adults suggest a general mechanism. No study has tested this hypothesis directly by comparing processing within the same individuals across multiple tasks. Older (ages 60-85) and younger (ages 18-30) adults participated in four tasks while EEG was collected: face processing (N170), attention and categorization (P3), semantic processing (N400), and error processing (ERN). Results showed differential age-related condition effects for different tasks. No age-related differences were found for the N170 and ERN, but smaller condition amplitude differences and less focal distributions of neural responses were found for the P3 and N400: Older adult amplitudes differed from younger adults only for the target condition (P3) and for related word-pair conditions (N400). An age by task interaction of standardized difference wave amplitudes confirmed these differences. Thus, aging does not affect neural processing similarly across these four cognitive tasks within individuals.

This experience was funded by: Kolenkow-Reitz Fellowship

https://osf.io/rtu7m/

143. Michaela Polley

Class Year: 2023
Major(s): Chemistry, Mathematics
Supervisor(s) and affiliation or institution: Christopher J. Ellison (Professor of Chemical Engineering and Materials Science, University of Minnesota), Theresa M. Reineke (Professor of Chemistry, University of Minnesota), Erin Maines (Ph.D. Candidate in Chemical Engineering, University of Minnesota)

Title: *Recycling Photopolymerizable 3D Printing Resin*

3D Printing has in recent years taken on a greater role in the medical, automotive, and other industries. One popular form of 3D printing is vat photopolymerization, which uses a laser to cure a vat of liquid resin one layer at a time and allows for very intricate parts. Since this is a cross-linked, thermoset material, traditionally it has not been recyclable. We developed a procedure for incorporating used material back into the pure resin to increase sustainability. Using FormLabs Clear and Elastic resins as a model system, we were able to reach and exceed 10 weight percent of recycled content incorporation without loss of mechanical properties by adding a radical scavenger during milling.

144. Leo Qi

Class Year: 2024
Major(s): Undecided
Other Authors/Contributors: Augustus Williams
Supervisor(s) and affiliation or institution: Joe Chihade (Professor of Chemistry, Carleton College)

Title: *Broadening the Scope of a Spectrophotometric Aminoacylation Assay*
Developing an efficient and accessible assay to monitor the aminoacylation of alanyl-tRNA would greatly facilitate research on protein biosynthesis conducted in our laboratory, given that the current method (using radioactively labeled alanine) is slow, costly, and requires specialized equipment and training. Our project attempts to broaden the scope of a successful spectrophotometric aminoacylation assay, which was first developed to monitor tyrosyl-tRNA synthetase activity, to other systems. In this assay, the formation of AMP during the aminoacylation reaction is coupled with the production of NADH. The occurrence of NADH can be measured spectrophotometrically at the wavelength of 340 nm.

We are currently purifying the enzymes that are involved in the assay and optimizing the procedure for preparing these proteins. We have shown that the enzymes made are functional. Our next steps will be integrating the coupled assay with the aminoacylation of alanyl-tRNA.

145. Shaw Qin

Class Year: 2022
Major(s): Psychology

Title: *Online Collaborative Library Research in Educational Psychology and Organizational Psychology*
I spent the past summer working as an educational psychology and organizational psychology research intern at 1Cademy, a non-profit collaborative online community supporting interdisciplinary research and learning through content generation, mapping, evaluation, and practice. My internship consists of two parts: doing literature review in educational psychology and organizational psychology to fill in the gaps in the knowledge map on 1Cademy's website, https://1cademy.com, and narrowing down a research direction with interns interested in original research on microtasking.

146. Alek Rabago

Class Year: 2023
Major(s): Chemistry
Supervisor(s) and affiliation or institution: Deborah Gross (Professor of Chemistry, Carleton College)

Title: *Cooking Should Not Kill: Indoor Air Quality in Rural Households in Ethiopia*

The burning of biomass fuels for indoor cooking leads to dangerously high concentrations of indoor air particulate matter, with those exposed to it being far more likely to experience symptoms associated with respiratory disease and other health hazards. Families in lower socioeconomic status in developing nations are often reliant on wood as their primary source of fuel, leading to further elevations of observed indoor concentrations. By measuring and performing statistical analysis of PM2.5 (the leading metric of particulate matter for indoor spaces) levels, we can conclusively determine the magnitude of concentrations to which individuals in these households are exposed. Results from a study of emissions in rural households in Wolkite, Ethiopia illustrate the impact of cooking with wood using traditional three-stone fires and the improvements in air quality that can be achieved when switching to improved cookstoves.

147. Samihat Rahman

Class Year: 2022
Major(s): Chemistry
Supervisor(s) and affiliation or institution: Patanjali Kambhampati (Professor of Chemistry, McGill University)

Title: *CsPbBr3 Perovskite Nanocrystals: The Effect of Changing Surface Ligands on Photoluminescence*
Halide perovskites are a relatively new class of materials, especially in comparison to the nanocrystal predecessor cadmium selenide. The high tunability of the semiconductor band gap in the perovskites leads to efficient light emission, which can aid in making more effective solar cells. Nanocrystal or colloidal stability is another important aspect of perovskites and is dependent on the surface ligands. Therefore, I studied the effect of four different organic ligands on the light emission and stability of CsPbBr3 nanocrystals. From a preliminary study, I found that lecithin, a class of phosphocholine, and a mixture of dioctyl phosphoric acid and oleylamine were the two ligands that yielded the most stable nanocrystals while also maintaining efficient emission. Temperature dependent studies yielded variability in the wavelength shift with temperature for the ligands, indicating an association between surface ligands and the crystal structure; however, more studies need to be done to obtain conclusive evidence.

148. Trent Ramirez

Class Year: 2023
Major(s): Economics

Title: *Financial Analyst Summer Internship at Yavrucu Capital*
In the Summer of 2021, I worked as an analyst at Yavrucu Capital in Miami, Florida. This position allowed me to explore the finance field by working at a hedge fund that focused on emerging markets and bonds. My internship differed from my previous experiences working exclusively with U.S market equities.

149. Lora Randa

Class Year: 2023
Major(s): Biology
Other Authors/Contributors: Eledon Beyene

Supervisor(s) and affiliation or institution: Joe Chihade (Professor of Chemistry, Carleton College)

Title: *Stabilizing an Unstable and Pathogenic Mutant Protein*
Mutations in the AARS2 gene, which codes for the mitochondrial alanyl tRNA-synthetase protein, are linked with severe disease, including infantile cardiomyopathy and leukodystrophy. Our laboratory is interested in understanding, on a molecular level, why different mutations result in different disease phenotypes. However, attempts to produce these mutant proteins using a bacterial expression system have been unsuccessful, resulting in poor expression of low-purity proteins. We are interested in improving expression of these mutants through the addition of a solubility tag to facilitate the purification of full-length mutant protein. Addition of an MBP solubility tag greatly improved purification of the wild type protein and improved expression of mutant protein.

We are investigating strategies for solubility tag removal which will result in intact full length protein. We will then compare mutant proteins' stability using a thermofluor assay, in which binding of a fluorescent dye is used to measure the degree of protein unfolding.

This experience was funded by: Platinum/Bergman Fund

150. Carlos Reyes Rojas

Class Year: 2022
Major(s): Political Science/International Relations

Title: *The Immigrant Law Center of Minnesota*
This summer I interned at the Immigrant Law Center of Minnesota (ILCM), a nonprofit agency that provides immigrant legal assistance to low-income immigrants and refugees. At ILCM, I was a part of the of the Pro Bono team which focused on DACA and naturalization clients. I conducted screenings with clients, assisted with pro bono case placement procedures, and provided support on a wide variety of immigration cases. Some of my highlights this summer include: being a part of the emergency DACA response team, getting interviewed by MPR about DACA, advocating for the reconciliation bill by speaking to Congressional staffers, and working on a podcast with American Refugee about DACA.

This experience was funded by: Social Justice Internships funds from the Chaplain's office

151. Silas Rhyneer

Class Year: 2022
Major(s): Computer Science

Title: *Machine Vision Engineering at Clean Energy Associates*
I spent this summer living in California, working at Clean Energy Associates, being funded by Carleton's Global Edge program. I wrote scripts for automating menial tasks from other interns, I developed a program for quickly generating lots of training data for algorithmic learning, and ultimately, set up and developed a machine learning algorithm for automatically segmenting images of solar panels into their component cells.

This experience was funded by: Student Internships Endowed Fund

152. Diana Rodriguez

Class Year: 2022
Major(s): Chemistry

Supervisor(s) and affiliation or institution: Deborah Gross (Professor of Chemistry Professor, Carleton College)

Title: *Cooking Should not Kill: Restaurant Indoor Air Quality in Addis Ababa, Ethiopia*
Biomass fuel burning results in hazardous indoor air pollution. Individuals exposed to high concentrations of pollution while cooking are more likely to experience respiratory disease and have long-term health impacts. While previous studies have delved into vulnerable populations in households, restaurant staff are exposed to pollutants for entire workdays. Measurements of PM2.5, or inhalable particles, in indoor spaces illustrate the impacts of burning fuels such as charcoal, wood, and LPG, as well as improved cookstoves.

153. Maya Rogers

Class Year: 2022
Major(s): Psychology

Title: *Mapping Misperceptions: Ideological Threat Shapes Visual Representations of Public Health Organizations*
In this study, we asked how people visually perceive threats to their ideological beliefs (such as abortion ideology) and proposed two competing hypotheses: exaggeration or minimization. Participants saw a map with approximately 1,450 pins and were told the pins represent either abortion providers, crisis pregnancy centers, or the American Red Cross. More religious participants tended to over-estimate the number of abortion centers, supporting a threat exaggeration effect. However, greater religiosity also predicted seeing more crisis pregnancy centers. In addition, the more participants felt the image threatened their values, the more locations they estimated there to be. Moreover, the more locations participants estimated, the greater their intentions to act in line with their ideological beliefs, providing support for the function of threat exaggeration. This study serves as a preliminary step in examining whether perceptual biases emerge to protect existing ideological beliefs.

154. Magdalena Rohde

Class Year: 2023
Major(s): Physics
Supervisor(s) and affiliation or institution: Cindy Blaha (George H. and Marjorie F. Dixon Professor of Physics and Astronomy, Carleton College)

Title: *Investigation into Potential Supernova Remnant Candidate "Bubbles" in Galaxy M33*
This investigation aimed to observe "bubbles"—potential supernova remnant (SNR) candidates—in and around the hydrogen-rich regions of galaxy M33 as part of surveying the local group galaxy region (Milky Way, Andromeda); hydrogen-rich regions can indicate the potential presence of stellar phenomena and the remnants left at the end of their life cycle. In turn, SNR candidates can be identified by their SII:H-Alpha (Sulfur II: A hydrogen spectral line) and OIII:H-Alpha (Oxygen III) ratios. After manually identifying SNR candidates in specific regions of M33, their identifying data was extracted from a catalogue of surveyed regions in the galaxy, via computer programs run via IDL Pipeline to create a new list. Then, I took their hydrogen, oxygen, and sulfur fluxes, created extinction-corrected luminosity functions and graphed the ratios to look at their spectral lines. The graphs show typical emission lines for SNRs.

155. Hashir Safdar

Class Year: 2022
Major(s): Computer Science

Title: *Software Engineer Internship*
Worked alongside a team of software engineers, designers, and product managers to develop a trading platform for physical commodities.

This experience was funded by: Wiebolt Endowed Internship Fund

156. Adi Satish

Class Year: 2023
Major(s): Biology

Title: *The Community Action Center of Faribault*
During my 2020 Summer Break, I worked at the Faribault Community Action Center, a food shelf and resource center that was in its early stages of development. Because of this, the work I performed, week to week, was everchanging. Some weeks were focused on planning mobile distributions, which involved us traveling to four locations in Faribault and giving out fresh produce, meat, dairy, and a box of assorted non-perishable food items. Other weeks were focused on engaging with the community; for example, Evenings in the Park was an event every Monday evening where we would talk to community members in their neighborhood about the CAC. Sometimes, my job was all about logistics: from organizing a group of 50 volunteers, to developing instructional videos about how to operate various heavy machinery, to developing an evacuation protocol in case of an environmental disaster and determining whether our center was in accordance with fire safety protocols.

This experience was funded by: CCCE Internship

157. Emily Schulenberg

Class Year: 2022
Major(s): Statistics
Supervisor(s) and affiliation or institution: Rika Anderson (Assistant Professor of Biology, Carleton College)

Title: *Ocean Memory*
Ocean memory is the idea that microbes can encode specific genetic information that allows them to remember various environmental conditions. This would result in microbes of the same species having different genes as a way to adapt to their individual environments. Saanich Inlet is an oxygen minimum zone off the coast of Washington State. Since oxygen levels vary by depth and location, microbes within Saanich Inlet may show evidence of ocean memory. This research aimed to look for indications that ocean memory is present in the Saanich Inlet. Using bioinformatic analyses, this project classified different genomes that were found in the samples. Microbial families were found to vary across depths with little overlap between the shallowest and deepest samples suggesting depth might determine microbial diversity. Future research should look into how microbial families vary across locations and how individuals of the same species may vary genetically in different environmental conditions.

This experience was funded by: Towsley Endowment

158. Scott Shafer

Class Year: 2022
Major(s): Classics
Other Authors/Contributors: William North
Supervisor(s) and affiliation or institution: William North (Professor of History, Carleton College)

Title: *Translating the Life of Jean Bolland: A Study in the Hagiography of Scholarship in the 17th-Century*
In 1629, a Jesuit priest named Jean Bolland began work on the Acta Sanctorum: a monumental 68-volume edition of the lives of Christian saints, organized according to the liturgical year. He built upon the plans of Dutch Jesuit Heribert Rosewyde, who envisioned publishing reliable editions of the texts bearing witness to all of the saints but died before work began. Remarkable for the scope of the undertaking and Bolland's use of historical criticism, the Acta Sanctorum was a major, and controversial, milestone in the development of hagiography that sought to give this aspect of Catholic religiosity a foundation capable of critical scrutiny. Composed by Daniel Papebroch, the post-mortem biography of

Bolland is a key witness to the early history of this project, shedding light on Bolland's life and education, and showing the way in which educational and religious institutions of early modern Europe shaped his academic acumen and scholarly process.

159. Ananya Shah

Class Year: 2022
Major(s): Chemistry, Sociology/Anthropology
Supervisor(s) and affiliation or institution: Santiago Garcia (Minneapolis Heart Institute Foundation)

Title: *Clinical Characteristics and Outcomes of Patients with Myocardial Infarction with No Obstructive Coronary Arteries (MINOCA) Presenting with ST-Segment Elevation*
Myocardial infarction with nonobstructive coronary arteries (MINOCA) is clinically defined by the presence of 1) Positive troponin 2) < 50% stenosis on angiography 3) No clinically overt cause for acute presentation.
Patients with MINOCA contribute 3% to 15% of all cases of acute myocardial infarction (AMI). These patients have less severe atherosclerosis, are more likely to be younger, female, and less likely to have hyperlipidemia.
Cardiac Magnetic Resonance Imaging (cMRI) serves as a clinical tool to establish a diagnosis of MINOCA, despite explanatory stenosis. There is limited data regarding the clinical profile and follow-up status of MINOCA patients.

160. Mehdi Shahid

Class Year: 2022
Major(s): Physics

Title: *Assessing the Speed and Accuracy of Real-time Motion Tracking Algorithms for Abdominal Organ Motion Management in a 1.5T MR-Linac System*
Background: Real-time magnetic resonance imaging (MRI) using the novel MR-Linac provides the opportunity for organ motion tracking during MRI-guided radiotherapy. Managing organ motion is important in radiotherapy to mitigate normal tissue toxicities. This work investigates the efficacy of three algorithms for real-time organ motion tracking.

Methods: Algorithms based on template matching were chosen to determine the 2-D displacement of an abdominal target region. We measured the efficacy of Normalized Cross Correlation (NCC), Mutual Information (MI) and OpenCV's Kernelized Correlation Filter (KCF) motion tracking methods by measuring the computation speed of the algorithm and the spatial accuracy of the predicted template location throughout the exam.

Results: OpenCV's KCF algorithm provides the fastest speed of 12 +/- 1 ms per frame and the most feasible motion tracking for real-time abdominal targets.

Conclusion: This work shows the feasibility of three motion tracking algorithms to track organ motion during MR- guided radiotherapy on the MR-Linac. Further development to incorporate the algorithm with MR-Linac technology is needed in implementing such trackers for continuous clinical use.

161. Lucy Shapiro

Class Year: 2023
Major(s): Chemistry

Title: *Food Systems and Reclamation Research Internship*
Inspiration Corporation assists people who are food insecure. Inspiration Corporation produces and provides nutritious meals to its participants and to others in the community using donated and reclaimed food products. The goal of my research is to help Inspiration Corporation assess how it may increase donation and reclamation of food resources and guard against disruption to this food supply chain. To investigate these issues, I interviewed key members of the food reclamation and food waste community and conducted supplementary research on food systems and organizations that are working to feed people and eliminate food insecurity. My research identifies steps Inspiration Corporation may take to increase its food recovery efforts and donations, including additional participation in stakeholder communities and community engagement. In addition, the individuals whom I interviewed stress the importance of producing meals that recipients feel treat them with dignity – meals that are nutritious and culturally familiar for them.

162. Ming Shen

Class Year: 2023
Major(s): Biology

Title: *Determining a Pathological Model for Delayed Gut Transit in Parkinson's Disease Using Drosophila*
Constipation affects patients with Parkinson's disease and frequently occurs before the onset of motor deficits. To confirm that delayed gastric transit takes place prior to the onset of motor symptoms, we performed constipation and locomotion assays at day 1, 3, and 10 post-eclosion in flies expressing alpha-synuclein in all neurons. We performed these same assays with flies expressing alpha-synuclein under restricted neuronal drivers at day 10. Inconclusively, we saw neither constipation nor motor deficits at day 1 and 3. However, expressing alpha-synuclein in cholinergic and GABAergic neurons decreased locomotor behavior, but to a lesser extent when compared to the diminished locomotor behavior in flies expressing alpha-synuclein in all neurons. Our findings indicate a need to assess constipation and locomotion at timepoints between day 4 and 10. We must also determine if non-dopaminergic neurons and glial cells have a combinatory effect on locomotion and expand our assays to other neuronal populations.

163. Yicheng Shen

Class Year: 2022
Major(s): Political Science/International Relations, Statistics
Other Authors/Contributors: Yucheng Yang
Supervisor(s) and affiliation or institution: Adam Loy (Assistant Professor of Statistics, Carleton College)

Title: *Exploring the Finite-sample Behavior of Residual Diagnostics for Linear Mixed-effects Models*
Understanding the residual behaviors has always been a key challenge for analysts who need to examine the validity of fitted models. In the framework of linear mixed-effects (LME) models, we employ simulation based methods that provide an abundant set of artificial data and models with and without deficiencies to explore the finite-sample behavior of residual diagnostics. The results of our simulations point to the intertwined nature of LME model assumptions: a single or pair of misspecifications often lead to structures in residual plots that could be flagged as problematic to other assumptions. The way in which the hierarchical data was composed, namely cluster sizes, residual variances and longitudinal settings, also have influential repercussions to the established residual diagnostics. These findings have major implications for the LME model checking procedures using residual analysis and can serve as modeling guidelines for interpreting diagnostic plots and test statistics.

https://documentcloud.adobe.com/link/review?uri=urn:aaid:scds:US:a84c22fb-9ff3-4536-837f-52489aaae00c

164. Isaac Simons

Class Year: 2023
Major(s): Economics

Title: *Travelers Insurance: A Case Study to Explain Reinsurance*
Reinsurance is one of the oldest financial industries in the world, yet few individuals know of its existence. Whether it be a natural catastrophe or a surgery gone wrong, it is working behind the scenes to help both companies and people alike. In essence, reinsurance is insurance for insurance companies and it plays a vital role in risk mitigation and distribution.

As a broker intern for LocktonRe, I gained intimate knowledge of the historic reinsurance industry and its impact on the world. Specifically, I worked with both the medical malpractice and property teams to ensure proper data collection and distribution. Thanks to this opportunity, I was able to expand my analytic skills as well as my knowledge of the financial world.

165. Cassie Smith

Class Year: 2022
Major(s): Geology
Supervisor(s) and affiliation or institution: Sarah Titus (Professor of Geology, Carleton College), Jacqueline Reber (Associate Professor of Geologic and Atmospheric Sciences, Iowa State University)

Title: *Effects of heterogeneity on inferred stress directions using borehole breakout orientations: A physical modeling approach*

Stress measurements in the crust are useful for understanding plate tectonic processes and seismic hazards. One common data set for inferring stress comes from boreholes. To link borehole observations to stress directions, geologists assume that the crust is homogeneous and isotropic. However, recent studies indicate that stress directions inferred from boreholes in anisotropic rocks may be misleading, as the orientation of breakouts are affected by heterogeneities within the rock.

To expand upon these recent studies, I take a physical modeling approach to study the effects of anisotropy on borehole behavior. My model material is gelatin. The gelatin is prepared in three different manners: homogenous and unlayered; horizontally layered; and obliquely layered. Each block of gelatin is compressed, a borehole is created, and vegetable shortening is poured into the borehole to preserve its shape for further analysis. My preliminary results suggest that layers do affect the breakout orientations. Future work aims to clarify the geometric relationships between the applied stress field and breakouts.

166. Collin Smith

Class Year: 2022
Major(s): Mathematics
Supervisor(s) and affiliation or institution: Kate Meyer (Assistant Professor of Mathematics, Carleton College)

Title: *The Importance of Being Discrete: Dynamics of Flow-Kick Disturbance Models*

Disturbances such as rain events, fires, and harvests shape earth's ecosystems and are changing in response to human impacts such as climate change and natural resource management. Flow-kick models offer an alternative to traditional ODEs to capture the discrete flavor of such disturbances. In this poster, we examine the connection between continuous disturbance models and their flow-kick counterparts. We ask which features of a continuous disturbance model persist in general to nearby discrete models, and what new behavior we might discover by going discrete

167. Madi Smith

Class Year: 2022
Major(s): Psychology

Title: *Interacting With Nature: Research With The Watson Lab*

My internship took place at University of Colorado, Denver Campus in the Psychology department. Specifically, I worked in the Watson Lab which is Cognitive Neuroscience based. This field of research does various studies focused on how interaction with nature, wither that be physically or through images, impacts various aspects of cognitive functioning. Currently they are researching how the amount of time people view nature images affects performance on cognitive tasks.

168. Leah Snidman

Class Year: 2022
Major(s): Biology, Chemistry

Other Authors/Contributors: Tatiana Jimenez
Supervisor(s) and affiliation or institution: Christopher Calderone (Associate Professor of Chemistry, Carleton College)

Title: *Examining Differences in the Binding Sites of Succinyl Transferases DapD and TabB*
Succinyl transferases are enzymes that add succinyl groups onto a substrate. This project centers upon TabB and DapD, succinyl transferases which act on THDPA in tabtoxin and lysine biosynthesis, respectively. Although TabB and DapD are functionally similar, they have distinct binding sites. The plasticity of the TabB and DapD binding sites were explored via the creation of mutants which altered amino acids in the binding sites. Kinetic assays on the mutated proteins allow us to analyze how the mutations alter the function of the proteins. The results of these assays can provide useful information about the mechanism of TabB and DapD.

This experience was funded by: NSF Grant

169. Natalie Soehnlin

Class Year: 2023
Major(s): Physics
Supervisor(s) and affiliation or institution: Valerie Fox (Post-Doctoral Associate, Earth and Environmental Sciences, University of Minnesota-Twin Cities)

Title: *Contextualizing CRISM Clay Mineral Detections in Glen Torridon, Gale Crater, Mars, Using MARDI on the Curiosity Rover*
Glen Torridon (GT) is a region in Gale crater, Mars, that is known for increased CRISM (Compact Reconnaissance Imaging Spectrometer for Mars) detections of clay minerals. The Curiosity rover conducted in-situ observations in GT from January 2019 through April 2021, confirming predicted clay mineral abundances and speciations. However, Curiosity had measured clay minerals in similar abundances in regions that do not have similar GT CRISM signatures. In order to determine potential reasons for these CRISM measurements in GT, we analyzed images from Curiosity's MARDI (Mars Descent Imager) to determine the size distribution of surface rocks throughout its traverse. We determined that higher detections of clay minerals are somewhat correlated with higher instances of smaller rock fragments while lower detections of clay minerals are somewhat correlated with higher instances of larger rocks and bedrock. This suggests physical erosion and surface exposure are also factors to consider when interpreting orbital spectral data.

This experience was funded by: FATH

170. Henry Sottrel

Class Year: 2023
Major(s): Physics
Supervisor(s) and affiliation or institution: Helen Minsky (Assistnat Professor of Physics, Carleton College)

Title: *Probe Fabrication for Probe Tack Tests*
A probe tack test is a common way to measure the adhesion of an object. Since the debonding process of the material can depend quite sensitively on the physical properties of the probe used, the choice of probe is important one to ensure that measurements are of high quality. I investigated several methods of probe fabrication for probe tack measurements, and ultimately determined that glass-tipped probes are likely the best choice.

This experience was funded by: Dean of the College Office SRP

171. Astrid Steiner-Manning

Class Year: 2022
Major(s): Environmental Studies

Title: *Internship With the Boston Outdoor Preschool Network*
I spent the summer interning with the Boston Outdoor Preschool Network. I worked with a class of sixteen children, aged two to seven, and helped facilitate them as they learned with nature. I had the opportunity to see outdoor education in action, to better understand early childhood development, and to learn about the plants and animals of the Arnold Arboretum alongside the children.

This experience was funded by: Environmental Studies Department

172. Annabella Strathman

Class Year: 2022
Major(s): Chemistry
Supervisor(s) and affiliation or institution: Scott Kaufmann (Mayo Clinic)

Title: *CDC25A Mediates Acquired Resistance to CHK1 Inhibitors in Ovarian Cancer*
Replication stress (RS) threatens cancer cell survival, requiring their increased reliance on various DNA repair machineries. A pathway central to this response is governed by ataxia-telangiectasia-mutated-and-Rad3-related kinase (ATR) and downstream proteins, including mitotic kinase WEE1 and checkpoint kinase 1 (CHK1). Over the last few years, preclinical and clinical evidence shows that inhibitors of ATR, WEE1, and CHK1 are promising candidates in monotherapy and combination settings. Nonetheless, there is poor understanding of response mediators to these therapies and their primary mechanism of cell death. The present study aimed to investigate the apoptotic pathways that are engaged by these replication checkpoint modulators and assess mechanisms involved in resistance to them. Preliminary examination of isogenic HGSOC lines (parental and resistant to the CHK1 inhibitor prexasertib) demonstrated that protein phosphatase CDC25A was downregulated in resistant ovarian cancer cells (PrexR). This project investigated the functional relevance of CDC25A in resistance acquisition using siRNA knockdowns, immunoblotting and assays for apoptosis. Collectively, these results indicate that inability to upregulate CDC25A mediates acquired CHK1i resistance in preclinical ovarian cancer models.

173. Osip Surdutovich

Class Year: 2023
Major(s): Mathematics, Physics

Title: *In Search of the Galactic Center Excess: New Templates for the Inner Galaxy*
{T} {he} Galactic Center Excess (GCE) is an unexplained excess of gamma ray radiation, with energy above 1 GeV, identified at the center of the Milky Way. The GCE was detected in 2009 by the Fermi-Large Area Telescope (LAT). Over the past decade many methods were introduced to find the culprit for the excess. In our work we create new galactic diffuse emission templates in order to analyze the galactic disk. We seek to use a larger number of models to discover more about the GCE emissions, its spectrum, and morphologies at various energy ranges. We use 14 distinct energy bins, between 0.3 and 35 GeV, and incorporate 80 physical models for the production of fitted templates to the data. We produce high resolution maps for the entire inner 60 by 60 region of the galactic sky, relying on the 12 years of observations. We find that the GCE is spherically symmetric, i.e. it has no elongation along, or perpendicular to, the galactic disk. We also find that the GCE does not follow a morphology similar to the Galactic Bulge. This finding suggests that the origin of the GCE cannot be entirely sourced by a stellar population or a population of point sources, which follows a profile similar to millisecond pulsars.

At large, we have parameterized the systematic uncertainties of the GCE emission by analyzing the observations from the galactic disk. Such systematic uncertainties originate from astrophysical uncertainties associated with the galactic diffuse emission modeling. We present in our findings the calculated correlation matrix of the systematic uncertainties, which is crucial in the interpretation of the GCE. The implications of our findings suggest that the most likely source of the GCE is dark matter annihilation.

174. Bahar Tas

Class Year: 2023
Major(s): Cinema and Media Studies, Economics

Title: *Media Genome Analysis*
This summer, I had the opportunity to intern as a media genome analyst at Katch, a media analytics startup based in California, and to be a part of a team consisting of 140 film students from other prestigious universities. During these 10 weeks, I was introduced to the idea of genomic data and movie "genes" which can be most simply defined as a set of defining characteristics differing in their dominance/significance in each film. From their plot to cinematography, characters to settings, I was supposed to pay a lot of attention to the movies while watching them, take notes, and code them afterward. I coded 32 feature films in total over the course of 2 months. I am aware that this specific skill I gained might not be very applicable to future projects or jobs, but understanding the logic behind professional data collection processes will stay with me for long.

175. Drew Thompson

Class Year: 2023
Major(s): Physics
Supervisor(s) and affiliation or institution: Cindy Blaha (George H. and Marjorie F. Dixon Professor of Physics and Astronomy, Carleton College)

Title: *An Investigation into Morphologically Unique HII Regions*
A fundamental part of astrophysics is understanding the evolution of galaxies. One of the largest ways we have gained an understanding of this subject is by analyzing HII region- areas of hydrogen that have been ionized by nearby stars. These are created and grow as stellar radiation photo-evaporates, or pushes away, heavier elements and leaves behind relatively spherical HII regions. Some of these regions, however, are shaped linearly, which suggests that they may have formed in a different novel manner. In this research project, we analyze the chemical abundances and luminosity of 178 linear regions and compare them to over 3000 normally shaped HII regions in search of evidence for another HII region formation mechanism.

176. Aubrey Thurman

Class Year: 2022
Major(s): Economics

Title: *Northfield Area Family YMCA Marketing and Communications Internship*
I worked as a Marketing and Communications Intern at the Northfield Area Family YMCA. My jobs included making videos, writing and designing case statements, and creating posters, yard signs, brochures, postcards, and more for various programs and events.

177. Zichen Tian

Class Year: 2022
Major(s): Biology, Psychology
Supervisor(s) and affiliation or institution: Jaime Grunzender and Yifei Cai (Yale University)

Title: *Proximity labeling proteomics of dystrophic neurite in mTOR knock-out AD mice model*
mTOR pathway is closely regulating I'm,portant protein synthesis that vital to organism survival. In AD human and mice model, the up-regulation of mTOR pathway and its downstream proteins are positively correlated with aggregation of beta-amyloid, the formation and accumulation of Tau. Because of the close connection between mTOR pathway and AD pathologies and the progression of cognitive impairment, we developed transgenic AD mice model (5XFAD-mTOR-AAV9-hsyn-cre-2a-GFP) with AAV-Delivered Cre-knockout mTOR pathway and compared with AD mice with regular mTOR pathway. We hypothesized that AD mice with inhibited mTOR pathway would reduce number of dystrophic neurites and reduced total maximum area of dystrophic neurites compared to AD mice model with regular mTOR pathway. We used Proximity labeling proteomics to quantify the number of dystrophic neurites within dystrophy halo in mice AD brain sections with double flourecence labelled Lamp1 (identify the axonal dystrophy halo) and GFP+.

178. Ahtziry Tinajero

Class Year: 2024
Major(s): Undecided

Title: *My Work Experience with the Carleton-Faribault PAR Collaboration*
The ACES Fellowship/Carleton-Faribault PAR Project allows college faculty to form lasting relationships with the Faribault community through participatory action research (PAR) to address the Faribault community's needs, especially in education. The research project involves both university-based research scholarship and knowledge from the community, so part of my responsibility includes familiarizing myself with the research, working on literature reviews, and writing about the project. Documentation about the research project and PAR is available through the PAR website, which is an important resource for community members and partners to know what has been accomplished through PAR and gives insight for those interested in getting involved with community-centered research like myself. Since this website is designed by and for the Faribault community, it is important to make the information on the website accessible to the Latinx community members by translating content in English to Spanish.

179. Amadou Tine

Class Year: 2022
Major(s): Economics

Title: *Commercial Export Internship at GESTOCI*
This summer I got the opportunity to travel to Cote d'Ivoire and intern at GESTOCI. GESTOCI is a petroleum stock management company that stocks petroleum for all of Cote d'Ivoire as well as parts of Mali and Guinea. I was interning in the export department which basically processed outgoing

shipments of petroleum products via invoice and bank statements. Most of my daily tasks included ledging amounts of petroleum products being transferred, processing invoices, and organizing transactions. Since GESTOCI is the leading stocker of petroleum products in Cote d'Ivoire, there are many transactions that occur at once and it is imperative that things are followed to a tee.

180. Ben Turner

Class Year: 2023
Major(s): Physics
Supervisor(s) and affiliation or institution: Ryan Terrien (Assistant Professor of Physics and Astronomy, Carleton College)

Title: *Investigating the Drift of the Habitable Zone Planet Finder Astro-Etalon Calibration System*
Searching for Earth-like planets orbiting M-Dwarfs using the Doppler effect requires high-quality calibration systems. The calibration spectra should provide narrow and stable lines that we can use to identify wavelength shifts in stellar spectra. Two frequently implemented systems are the Fabry-Perot Etalon and the Laser Frequency Comb (LFC). The etalon is more cost-effective and thus more common, but the spectral lines drift from each other over time, which hinders the measurements of Doppler shifts. This occurs with all Astro-etalons including the Habitable Planet Finder (HPF) system and so identifying the cause is imperative to advance the search for habitable planets further. Using a Gaussian fitting program with HPF data taken from August 2018 to July 2021, we tracked the drifts against the absolute standard of an LFC. We observe changes in the position and widths of the lines which we attribute to the etalon, analysis software, or even the spectrograph.

181. Jack Uchitel

Class Year: 2022
Major(s): Linguistics
Other Authors/Contributors: Isabella Cha
Supervisor(s) and affiliation or institution: Cherlon Ussery (Associate Professor of Linguistics)

Title: *Ditransitives in Insular Scandinavian and Korean*
Ditransitive constructions (sentences containing a subject and a verb with two objects) are a source of inquiry for semanticists, as one set of arguments can manifest in a double object (DO) frame or a prepositional (PP) frame. Linguists have argued about the nuances of the semantic inequivalences between the frames, developing a shortlist of theories. Our project extends this debate to Insular Scandinavian languages – we conducted an experiment asking Icelandic and Faroese speaking participants to gauge the grammaticality of sentences after introducing semantic information that compromises the integrity of a given ditransitive verb, which appeared in one of the frames. Furthermore, to expand our cross-linguistic understanding of this phenomenon, we researched ditransitive constructions in Korean, illustrating parallels between their machinery and that of Icelandic. Through this exploration, we studied inversion and the workings of case when creating ditransitive sentences.

182. Hana Uyeda

Class Year: 2022
Major(s): Geology

Title: *Resisting Line 3*
I spent the summer working at three organizations all started and run by activist and writer Winona LaDuke. The organizations were Winona's Hemp Farm, Anishinaabe Agricultural Institute and Honor the

Earth. My geology comps will be based on what I learned this summer. It will mainly focus on Ricing practices up north and consequences that the pipeline will have on Manoomin (wild rice.)

This experience was funded by: Kolenkow-Reitz Fellowship

183. Saraswati Vadnais

Class Year: 2022
Major(s): English

Title: *LearningWorks Summer Teaching Fellowship*
During my summer teaching fellowship, I independently designed a five-week literature curriculum for two 7th grade classes, based on the graphic memoir They Called Us Enemy, by George Takei. Classes read and analyzed the book, learned about different literary devices, and practiced analytical and creative writing. As their final project, the students wrote 2-3 page memoirs and illustrated them in the style of a graphic novel spread. I also designed and co-taught a four-week course on analog animation for nine students between 7th and 9th grade. I guided students through the completion of two major projects: a flipbook and a clay stop-motion animation. My additional responsibilities included leading student peer groups and daily activities.

This experience was funded by: Project 60 Endowed Internship Fund

184. Samantha Vera Leyva

Class Year: 2022
Major(s): French and Francophone Studies, Sociology/Anthropology
Supervisor(s) and affiliation or institution: Pamela Feldman-Savelsberg (Broom Professor of Social Demography and Anthropology, Carleton College)

Title: *The Politics of Deservingness for Queer Asylum Seekers at the US-Mexico Border*
Faced with homophobic and transphobic conditions that threaten their lives, more and more people flee their home countries and arrive at the United States's southern border to file asylum applications based on their sexual orientation or gender identity. At the border, migrant aid organizations offer asylum seekers legal assistance to complete the process. How is queer asylum's "deservingness" constructed and how does it influence migrant aid organizations' volunteers decision-processes? During a two-month volunteering experience with a migrant-aid organization, I reviewed more than 300 self-administered risk assessment surveys from asylum seekers and conducted in-depth analysis of 25 responses from LGBTQ+ asylum seekers to shed light on my questions. My findings suggest that: 1) migrants are, at least, partially aware of the deservingness properties and seek to meet them, and 2) volunteers are influenced by the construction of deservingness in choosing who to assist.

This experience was funded by: Mellon Mays Undergraduate Fellowship

185. Jed Villanueva

Class Year: 2022
Major(s): Cognitive Science
Supervisor(s) and affiliation or institution: Julia Strand (Associate Professor of Psychology, Carleton College)

Title: *Investigating the Effect of Noise on Listening Effort and Passage Recall*
Rabbitt (1968) was the first study to identify that background noise impairs cognitive processing during speech perception. In his third experiment, Rabbitt (1968) found that the recall for information presented in the first half of a passage was inhibited if the second half of the passage was presented in noise. Although fundamental to research on listening effort—the cognitive resources expended to understand speech—this finding has not been replicated. In addition, related research on visual enhancement has found disjunctions between self-report and behavioral measures; these measures intended to assess the same underlying construct found conflicting and even opposite results. The current study investigated subjective effort for speech in noise and attempted to directly replicate Rabbitt (1968). Although participants rated speech in noise as requiring more effort than speech in silence, the presence of noise did not significantly impair the recall of information.

186. Aswath Viswanathan

Class Year: 2023
Major(s): Political Science/International Relations

Title: *Industry Analyst at Arnell Capital*
This summer I was an Industry Analyst at Arnell Capital, a search fund in Chicago. I researched companies and compiled them into spreadsheets, in order to inquire about acquiring their business. I researched everything from the company's products to their executives using a software called Grata. I also helped create email sequences that were sent out to these executives, and tracked the effectiveness of our email program. As a whole I developed valuable research, communication, and excel skills.

187. Bryson Walker

Class Year: 2023
Major(s): Economics

Title: *Investment Analyst Research Presentation*
I was working remotely as an investment analyst intern at Decryption capital this summer. Decryption capital is an investment management firm with a sizeable portfolio of which I am not allowed to provide detailed financial information. I will be performing multiple tasks for Zhe Yang, the Director and President of Decryptional Capital. These tasks include updating monthly financial data for sensitive presentations and company records, completing research projects related to blockchain technology or industry changes/events, as well as doing ad hoc assignments for Mr. Yang. In addition, I created a weekly newsletter for the company that consists of weekly market-related data, market and government-related news, and cryptocurrency developments and news.

188. Mickey Walsh

Class Year: 2022
Major(s): Religion

Title: *The Advocates for Human Rights: Communications Internship*
I worked with the Advocates for Human Rights in their communications office. I did an umber of different things from managing their social media accounts to helping plan and set up for some of their summer events, most significantly helping at their booth at the Minnesota State Fair.

This experience was funded by: Rob White '85 Endowed Internship Fund

189. Alexis Walters

Class Year: 2022
Major(s): Geology
Supervisor(s) and affiliation or institution: Cameron Davidson (Charles L. Denison Professor of Geology, Carleton College)

Title: *Detrital Zircon U-Pb Dating of the Charleston Metamorphic Group, South Island, New Zealand*
The Charleston Metamorphic Group (CMG) is located in the footwall of the Paparoa Metamorphic Core Complex situated within the Buller Terrane of the North Island, New Zealand. The gneisses from the CMG contain major detrital zircon modes in the Devonian, Ordovician-Cambrian, and the Precambrian. The Buller Greywacke has been proposed as the protolith for the CMG gneisses. However, the presence of the Devonian mode in the CMG gneisses precludes the Buller Greywacke as a protolith, if the Devonian zircons have a detrital origin. The Buller Greywacke could be a protolith for the CMG if the zircons that compose the Devonian mode are metamorphic in origin.

This experience was funded by: NSF Grant

190. Hongshen Wang

Class Year: 2023
Major(s): Biology
Supervisor(s) and affiliation or institution: Li Wang, Xiaochun Wang, Eric Lin, Yupeng Li, Yinhan Zhang, Jennifer Heldring, Charles E Holmes Jr, Matthew D Kerr, Narayan Sahoo, Xiaorong Ronald Zhu, Steven J. Frank

Title: *Quantification of DNA Repair Related Foci Rad51 by Utilizing Fluorescence Intensity*
Radiation-induced DNA double-strand breaks are commonly assessed by manual quantification of foci formed by DNA repair proteins. Rad51 is a well-established biomarker of DNA homologous recombination repair (HRR). Here, we investigate the potential of measuring nucleus fluorescence as a new DNA damage quantification method. Head and neck cancer cells (SqCC/Y1) were exposed to a single dose of 4-Gy X-ray or proton radiation. Rad51 foci were visualized through immunostaining and fluorescence microscopy. ImageJ was used for fluorescence measurement. At 2 hours post-radiation, both manual counting and fluorescence measurement detects an increase in DNA damage in the treatment groups. There is no statistically significant difference between the increases detected by the two methods (p-value = 0.157059157 for the X-ray group, p-value =0.318216992 for the Proton group). This indicates that the fluorescence measurement method may be able to reflect the radiation-induced increase of early point Rad51 foci in the SqCC/Y1 cell line.

https://openworks.mdanderson.org/sumexp21/77/

191. Lauren Way

Class Year: 2022
Major(s): Chemistry
Supervisor(s) and affiliation or institution: Daniela Kohen (Professor of Chemistry, Carleton College)

Title: *Can transition state analogs be used to predict properties of a chemical reaction?*
In collaboration with the Alberg-Hofmeister group, I investigated the desymmetrization reaction of 3-methyl glutaric anhydride. Because similar reactions are synthetically useful, we are interested in understanding how it works. The reaction proceeds with the help of an organocatalyst, which stabilizes the species in between reactants and products, or the transition state (TS). However, the TS is not stable and thus when made in the laboratory it does not last long enough to be studied. In contrast, transition state analogs (TSAs) are stable molecules similar to the TS that will behave similarly experimentally. For this reason, my experimental collaborators synthesized a TSA for this reaction. I used DFT computational methods to simulate the interactions between the catalyst and both the TSA and the TS, with the end goal of better understanding the reaction mechanism. My findings so far suggest that the application of computational chemistry to this investigation is promising.

192. Sam Wege

Class Year: 2022
Major(s): Classics
Other Authors/Contributors: MJ Fielder Jellsey, Noah Eckersley-Ray, Sophie Rast
Supervisor(s) and affiliation or institution: Alex Knodell (Associate Professor of Classics, Carleton College)

Title: *Small Cycladic Islands Project 2021*
The Small Cycladic Islands Project is an archaeological project researching the smallest of the Greek Cycladic islands. Our goal is to identify occupancy and use patterns on these islands and to situate evidence of occupancy in its broader regional context in order to better understand the use of tiny islands as essential in-between places in wider Cycladic networks. The project has revealed evidence of these islets as religious sanctuaries, naval guard towers, castlets, and goat pastures. From this, we can conclude that these small Aegean islands have been used in a variety of ways dependent in part upon the islands' locations, surroundings, degrees of insularity, and quality and availability of resources.

https://smallcycladicislandsproject.org/

193. Piper Welch

Class Year: 2022
Major(s): Computer Science
Other Authors/Contributors: Kiara Johnson
Supervisor(s) and affiliation or institution: Anya Vostinar (Assistant Professor of Computer Science, Carleton College)

Title: *Endosymbiosis or Bust:*
Influence of Ectosymbiosis on the Evolution of Obligate Endosymbiosis
Endosymbiosis, symbiosis in which one symbiont lives inside another, is woven throughout the history of life and the story of its evolution. From the mitochondrion residing in almost every eukaryotic cell to the

gut microbiome found in every human, endosymbiosis is a cornerstone to the biological processes that sustain life on Earth. While endosymbiosis is ubiquitous, several questions about its origins remain shrouded in mystery, such as the precise conditions for its evolution. Modern science has hypothesized pathways: one where a obligate antagonism is co-opted into an obligate mutualism (Co-Opted Antagonism Hypothesis), and one where a facultative mutualism evolves into an obligate mutualism (Black Queen Hypothesis). Expanding on the evolutionary agent-based system Symbulation, we investigated the interaction between ectosymbiosis on de novo evolution of obligate endosymbiosis. We

found that introducing a facultative state selects for endosymbiosis. Specifically, we discovered that the presence of an ectosymbiotic intermediate stage encourages the evolution of endosymbiosis significantly more than simulations without such a stage.

194. Julian White-Davis

Class Year: 2023
Major(s): Political Science/International Relations

Title: *Balkan Echoes: Archival Assistant*
I had the honor of working with Martin Koenig this summer to assist him in various projects, including assembling an upcoming photography exhibition in Greece and organizing still and motion film to be shipped to the Library of Congress for archiving.

I worked alongside Koenig in his office, scanning film, darkroom contact sheets, and notebooks. As I worked, Koenig sat beside me and told stories of the people in the photos. Some of the biggest lessons I learned during this internship were through these stories. I listened for hours and hours as Koenig told of his adventures through the Balkans. I learned about how to secure funding for projects, how to find reliable people to work with, and above all how to respectfully and thoughtfully collaborate with photographic subjects. Koenig worked to develop deep ties with the communities he photographed, and he maintained those friendships even after returning to the US.

195. Jan Williams

Class Year: 2022
Major(s): Mathematics, Physics
Supervisor(s) and affiliation or institution: J. Nathan Kutz (Professor of Applied Mathematics, University of Washington-Seattle)

Title: *Data-Driven Sensor Placement for Fluid Flow Reconstructions Using a Shallow Decoder*
There are many situations in which we'd like to understand the global behavior of a system, but only have access to some small subset of measurements. As an example, consider the temperature of some lake or ocean. We would like to know the temperature in all regions, but only have a small number of sensors. Estimating the temperature in any one location has two problems then: how do we decide where to place sensors, and with that sensor data, how do we estimate the temperatures globally? Our work combines data-driven techniques for sensor placement with a shallow neural network to perform fluid flow reconstructions. We demonstrate superior reconstructive performance compared to previous techniques.

196. David Wilson

Class Year: 2022
Major(s): Chemistry
Other Authors/Contributors: Molly Kammann
Supervisor(s) and affiliation or institution: Joseph Chihade (Professor of Chemistry, Carleton College)

Title: *Exploring Helminth Aminoacyl-tRNA Synthetases*
Parasitic worms, also known as helminths, currently infect approximately 2 billion people worldwide. Existing treatment options are limited and many cause harmful side effects. We are working to investigate novel drug targets in these parasites. These include a family of enzymes that carries out an essential role in protein synthesis, aminoacyl-tRNA synthetases. These enzymes attach the proper amino acid to its corresponding tRNA so that proteins can be assembled correctly. Using genomic data to predict the protein sequences, we focused on the synthetases likely to differ most in structure from human homologues. We designed gene sequences to insert into E. coli with the intent of expressing and purifying the helminth enzymes. We accurately inserted eight of the sixteen synthetases of interest and attempted protein expression of five.

197. Lea Winston

Class Year: 2022
Major(s): History

Title: *Summer in Museum Education*
This summer, I interned at both the Rochester Art Center (RAC) and the Smithsonian's National Museum of the American Indian (NMAI). At RAC, I worked in-person with the educational department helping teach students ages six to eleven at Total Arts Day Camp. During weeks without camp, I worked on creating interpretive materials for the exhibitions including Spanish-language gallery guides. In addition to working at RAC, I also interned part-time and virtually with NMAI's Cultural Interpreter department. My projects supported the Youth in Action series where Indigenous Youth from the Western Hemisphere are invited to speak about their activism at online webinars. First, I developed a list of over 100 potential panelists who could participate in future series. I then created educational websites called Learning Labs for the upcoming September and October Youth in Action series on Environmental Justice in South America and Black-Indigenous Youth Advancing Social Justice, respectively.

198. Beck Woollen

Class Year: 2023
Major(s): Environmental Studies

Title: *Climate Justice Internship at MN350*
I spent this past summer as a Climate Justice Intern at MN350, a Minnesota-based non-profit environmental NGO. I worked primarily within the Pipeline Resistance Team, whose focus was #StopLine3 efforts. Despite having a remote-based internship, I was still able to connect with a variety of environmentalists and help with their impactful work at MN350.
The main projects I was involved in included managing the permit, setup, and teardown logistics for a 300-person event at the Minnesota State Capitol, helping coordinate a free-of-charge shuttle between

frontlines Line 3 camps, editing web content for MN350, and compiling a shared list of talking points for letters to the editor.

199. Ada Wright

Class Year: 2022
Major(s): Environmental Studies

Title: *Screen Time and Student Behavior: An Examination of Emotional Health and Physical Activity*
Over the summer of 2021, I participated in the STEER (Short Term Educational Experience for Research) Internship through the Center for Occupational and Environmental Health at UC Berkeley. Over the course of 9 weeks, I worked with professors, graduate students, and environmental health professionals as part of a long-term research project with the Stand Up Kids Foundation. Due to the impact of Covid-19 on school children, I decided to focus on associations between screen time, physical activity levels, and emotional-well-being to determine the impact of screens on pandemic-era students. Initial findings from my study suggest that students are not getting the recommended level of activity, while survey responses show students are concurrently spending far more time than recommended on various screen devices. Hopefully, this project will help the Ergonomics Lab team identify future intervention areas as the search for funding continues.

200. Josh Wu

Class Year: 2024
Major(s): Undecided

Title: *Internship at Versiti Blood Research Institute*
I learned the necessary skills, methods, mentality, and techniques to thrive in a real-world lab environment with hands-on practice. I was also able to connect with members of the lab to facilitate a better understanding of molecular biology and the science behind lab procedures. This internship allowed me to get comfortable in a real-world lab setting and sets me up for larger, independent projects in the future.

201. Xinyan Xiang

Class Year: 2022
Major(s): Physics
Supervisor(s) and affiliation or institution: Chris West (Visiting Assistant Professor of Physics and Astronomy, Macalester College)

Title: *Weak S-Process Nucleosynthesis in Massive Stars*
In this work, we calculate the weak component of the s-process. The weak s solar abundances are taken as residuals from previous computations for the main s component. To investigate possible differences in neutron exposures between both the main and weak components and the He-core and C-shell sites within the weak component itself, we complete the calculations using different neutron exposure distribution models: a linear combination of exponential distributions, a superposition of exponential distributions, a Gaussian distribution, and a Planck distribution. The solutions to the differential equation are assessed by tuning the fraction f of 56Fe seed nuclei and characteristic neutron exposure

τ0 as fit parameters. Preliminary results suggest a different neutron exposure distribution function is slightly better than or similar to the commonly applied exponential.

202. Xinyan Xiang

Class Year: 2022
Major(s): Physics
Other Authors/Contributors: Ben Aoki-Sherwood
Supervisor(s) and affiliation or institution: Jay Tasson (Associate Professor of Physics, Carleton College)

Title: *Gravitational Wave Veto Algorithm Comparison*

The LIGO Scientific Collaboration (LSC) is analyzing the data for direct observations of gravitational waves (GWs) of cosmic origin. Since the LIGO detectors are very sensitive, LIGO uses two "veto algorithms" to maintain the quality of data and minimize the effect of background noise by removing or "vetoing" contaminated data. These two algorithms are Hierarchical Veto (hVeto) and Used Percentage Veto (UPV). Both algorithms veto triggers in the gravitational wave strain channel by comparing strain channel triggers with triggers in auxiliary channels that monitor environmental disturbances. Triggers are noise transients that are deemed significant. Even though both UPV and hVeto veto triggers, the differences in functionality and in input parameters between the two algorithms make their performances different. To explore their differences and their respective advantages, we compared the characteristics of the performances of these two algorithms and hoped to provide suggestions for improving their use in the future gravitational wave data analysis.

203. Xavier Xiong

Class Year: 2022
Major(s): Biology

Title: *Lipid Energetics of Bullnose Rays: Comparison of TAG and FFA Concentration in Different Tissue TypesLipid Energetics of Bullnose Rays: Comparison of TAG and FFA Concentration in Different Tissue Types*

Bullnose Ray, Myliobatis freminvillii, is a benthopelagic species of ray that commonly found in coastal waters of the Western Atlantic. Bullnose rays are mesopredators (TL=3.23) that affect both upper and lower trophic levels. Studying the energetics of bullnose rays can not only inform fishery management, but also conservations of apex predators that feed on M. freminvillii. In most elasmobranchs, liver acts as the main energetic hub where FFA are turned into TAG for storage, and TAG are used energetic currency in muscle tissues. Myliobatis freminvillii (n=7) were caught as bycatch. Colorimetric assays are used to analyze TAG and FFA concentration in liver, plasma, and muscle samples. Intriguingly, unlike other species of batoids, adult bullnose rays have significantly higher concentrations of TAG and FFA in muscle tissues than in liver. Metabolically demanding feeding behavior and low energy density of the prey items offer a possible explanation for the abnormally high lipid content in bullnose ray muscles.

204. Jaren Yambing

Class Year: 2022
Major(s): Geology
Other Authors/Contributors: Ella Milliken, Demetrius Blackmon-Jimenez
Supervisor(s) and affiliation or institution: Dan Maxbauer (Assistant Professor of Geology, Carleton College)

Title: *Field trials and greenhouse experiments quantifying the carbon sequestration of enhanced weathering with basaltic soil amendments*

Enhanced weathering (EW) is a carbon dioxide removal technology that sequesters carbon dioxide by spreading crushed silicate rocks on Earth's surface. One of the primary applications of EW is in agricultural settings since the dissolution of silicate minerals releases cations into the soil solution as nutrients for crops and transfers carbon dioxide into bicarbonate. EW has significant potential to offset carbon emissions while improving crop yields and soil fertility for farmers. However, observational studies of EW are rare and there are large uncertainties regarding proposed benefits. Here we present preliminary results from a paired EW field trial and greenhouse study conducted in Northfield, MN. Carefully monitored field trials and greenhouse studies like ours are necessary to provide evidence of economically viable agricultural co-benefits and carbon sequestration rates to incentivize farmers and policymakers to adopt EW as a land management practice.

205. Jill Yanai

Class Year: 2022
Major(s): Music, Sociology/Anthropology

Title: *Methodologies, Barriers, and the Politics of Space: A Fieldworker's Approach to Recruitment and Retention of Participants for Clinical Trials at a Rural South African Clinic*

What social, cultural, spatial, and linguistic barriers impact the recruitment and retention strategies of fieldworkers in and community understandings of clinical trials? Over the course of a 10-week independent research internship set at a local HIV clinic in rural Cape Town, South Africa, I observed and notated the internal proceedings and logistics of a team of fieldworkers recruiting participants for vaccine trials. By focusing on the fieldworkers' positionality as community members and as educators/ representatives of sensitive medical knowledge, I offer qualitative, locally-based insights on how transnational clinical trials are implemented and executed on the ground. I conclude that further consideration must be given to address a variety of multifactorial and environmental stressors which hinder consistent recruitment and complicate understandings of the clinic. The development of interdisciplinary, culturally sensitive models will work to foster long-term ethical and collaborative recruitment measures for the staff and participants.

206. Michael Yang

Class Year: 2024
Major(s): Undecided
Other Authors/Contributors: Malachy Bloom, Jay Tasson, Vincent He
Supervisor(s) and affiliation or institution: Jay Tasson (Associate Professor of Physics, Carleton College)

Title: *Dispersion Analysis of Gravitational Waves*

General relativity (GR) predicts that gravitational waves (GWs) travel through spacetime at the speed of light, independent of their direction of travel and frequency. The Laser Inteferometer Gravitational-Wave Observatory (LIGO) detects GWs passing through Earth. With these detections, we test for gravitational Lorentz invariance violation
(gLIV). Tests for gLIV are part of a greater effort to unify the Standard Model and GR. To this end, we constrain 16 k coefficients by randomly drawing from the samples of 24 events. The results we obtain show no significant sign of gLIV.

207. Karina Yum

Class Year: 2023
Major(s): Religion

Title: *"Deconstructing" the House Upon the Rock: An Analysis of Ex-Evangelical Media*
Do people who leave organized religion deconvert completely? The ex-evangelical media I analyze in this essay shows that many ex-evangelicals do not abandon all notions of the divine, and are occasionally even compelled to create popular media such as podcasts and websites—to help consumers "deconstruct" or rethink their faith—which use rhetorical and aesthetic strategies characteristic of evangelicalism. I identify an "evangelical impulse" to create media that envisions the viewer as a lost, lonely, and confused subject, and then offers that viewer community, acceptance, and purpose. This strategy is central to evangelicalism's approach to religious conversion, and it remains evident in the rhetoric and aesthetics of nominally ex-evangelical media. My analysis of popular evangelical and ex-evangelical media suggests that comprehensive deconversion from evangelicalism as a faith in which rhetoric and aesthetics can be influential tools for conversion is a far more complex matter than a simple change in religious belief.

208. Mathew Zappa

Class Year: 2022
Major(s): Biology
Supervisor(s) and affiliation or institution: Nancy Braker (Puzak Family Director of the Cowling Arboretum and Senior Lecturer in Biology, Carleton College)

Title: *Rare Plant Surveys in the Carleton Arboretum*
As an arboretum research assistant this summer, one of my main tasks was surveying for and monitoring populations of rare plants that are found in the Cowling Arboretum and other Carleton properties. The species of interest were 3 species of sedge (Carex conjuncta, C. davisii, and C. grayi), Purple Rocket (Iodanthus pinnatifidus), and Prairie Bush Clover (Lespedeza leptostachya). Surveys for the first 4 species were conducted in the Arboretum's floodplain forest, while the bush clover monitoring was done at McKnight Prairie. Arboretum surveys documented new populations of all plants, which significantly expanded the known distribution of Carex davisii and purple rocket, as both species had been previously found at only 1 location. Prairie bush clover surveys at McKnight were focused on monitoring the size of known populations, and 2 additional populations were found and mapped.

209. Mary Zhang

Class Year: 2022
Major(s): Biology
Supervisor(s) and affiliation or institution: Kiryl Piatkevich (Westlake University)

Title: *Developing a Cell-based Sensor for Ang1-7 and AngII*
The pandemic of severe acute respiratory syndrome coronavirus (SARS-CoV-2) has taken many lives. It has been discovered that SARS-Cov-2 virus entry depends on the human angiotensin converting enzyme-2 receptor (ACE2). ACE2 is in charge of converting the high blood pressure inducing protein angiotensin II (AngII) into the seven amino acids peptide Ang1-7, which binds to MAS1 receptor and opposes the effect of AngII. Therefore, sensors that respond differentially to AngII and Ang1-7 can be used to infer the amount of ACE2 cleavage in virus infections. FOXO1, a transcription factor expressed in various

tissues, turned out to be such a potential candidate. Efforts and difficulties that went into developing this sensor is presented.