26th ANNUAL RESEARCH AND CREATIVE ACTIVITIES SYMPOSIUM (RACAS)

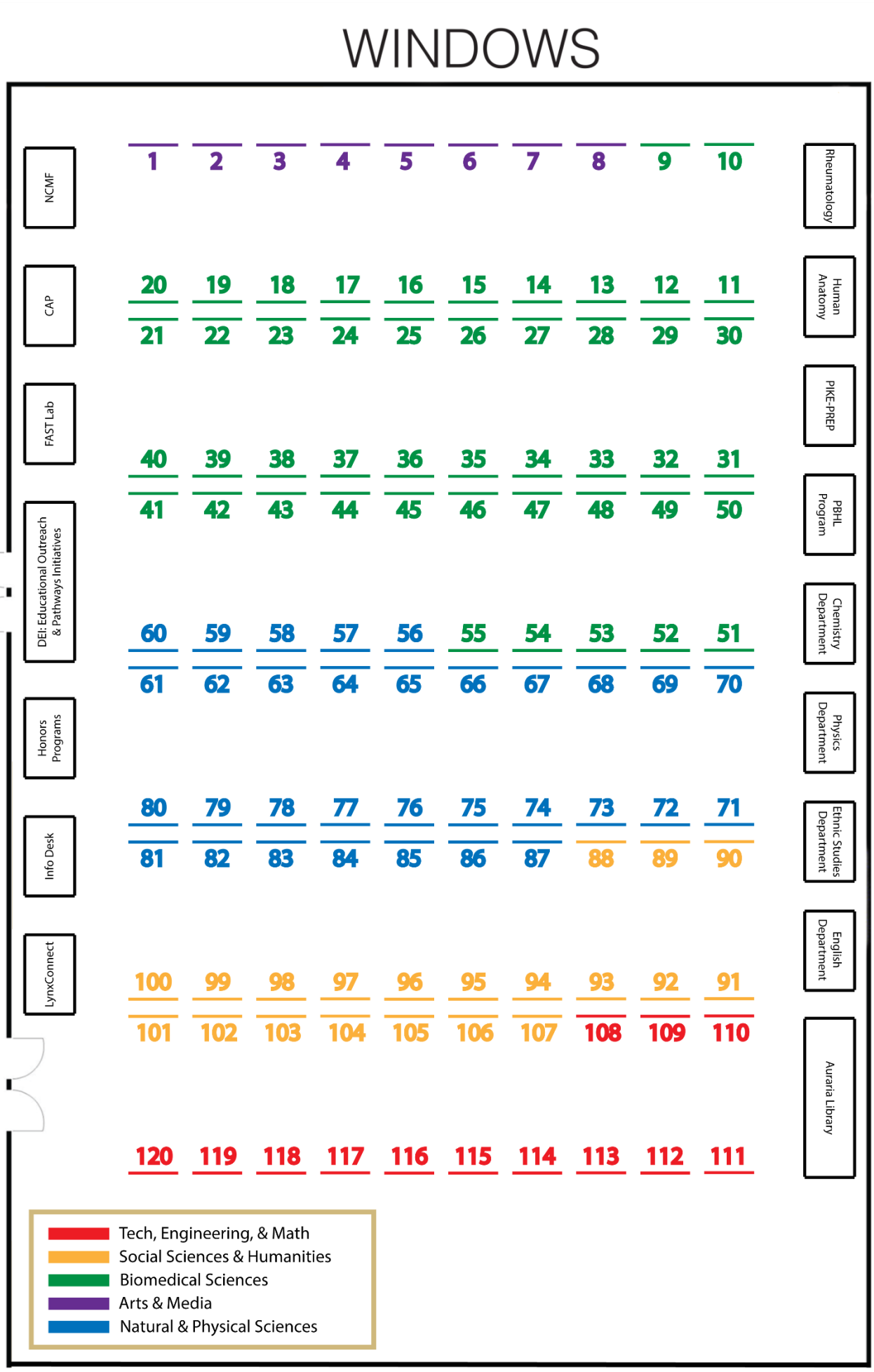
RaCAS is CU Denver's annual celebration of student-driven research, scholarship, and artistic endeavors. This year, we are thrilled to return to campus with a hybrid in-person event!

In our Virtual Project Showcase, you will find digital presentations showcasing the work of over 180 student presenters. We encourage you to take time to explore projects both within and outside your discipline - you never know where inspiration will strike! RaCAS is about community, conversation, and collaboration and we encourage you to use the comment walls to start a conversation with student presenters. Presentations will remain posted after RaCAS so you can continue to discover and enjoy them!

Full presentation details are available here: https://symposium.foragerone.com/2023-racas/presentations

RaCAS 2023 SCHEDULE

	Wellness Center Gym	Wellness Center Conference Room 2200	Learning Commons 2220 - Denver	Learning Commons 2222 - Adams	Learning Commons 2227 - Arapahoe	Learning Commons 2231 - Jefferson	Learning Commons 2230 - Learning Lab
8:00 AM	Exhibit Setup, Reviewer Check-in						
8:30 AM			Presenter Setup	Presenter Setup	Presenter Setup	Presenter Setup	Presenter Setup
9:00 AM	**Opening Remarks**						
9:45 AM	Posters up for asynchronous viewing						
			STEM Oral Presentations 1	**STEM Oral Presentations 2**	**Social Sciences & Humanities**	**Arts & Media Oral Presentations**	**President's Sustainable Solutions Challenge Oral Presentations**
10:00 AM							
10:30 AM							
11:00 AM							
11:30 AM	**Poster Sessions & Lunch** Resource Fair	**Xplore the Human Body in 3D Presentation**					
12:00 PM		**Xplore the Human Body in 3D Demonstration**					
12:30 PM							
1:00 PM							
1:45 PM							
	Grand Challenge Faculty Talks, Closing Comments, Awards						
2:00 PM							
2:30 PM							
3:00 PM							


WINDOWS
NCMF
CAP
FAST Lab
DEI: Educational Outreach & Pathways Initiatives
Honors Programs
Info Desk
LynxConnect
Rheumatology
Human Anatomy
PIKE-PREP
PBHL Program
Chemistry Department
Physics Department
Ethnic Studies Department
English Department
Auraria Library
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101 102 103 104 105 106 107 108 109 110
120 119 118 117 116 115 114 113 112 111
Tech, Engineering, & Math
Social Sciences & Humanities
Biomedical Sciences
Arts & Media
Natural & Physical Sciences

RACAS 2023 AWARD WINNERS

PEOPLE'S CHOICE AWARDS BY CATEGORY

- Arts & Media - **Madjelyn De Jesus**- Moyocoyotzin
- Biomedical Sciences - **Fahiima Abdullahi** - The Role of Mitochondria Metabolism in CD8 Cell Mobility
- Natural & Physical Sciences - **Jennifer Nguyen** - Construction of an Atomistic Model for the E318Q mutant for CLCF F-/H+ Antiporter
- Social Sciences & Humanities - **Annemarie Dupuy, William Navarrete Moreno, & Dien Thinh Nguyen** - Psychophysiological Responses to Anti-Immigrant Rhetoric: A Mixed-Effects Experimental Study among University Students
- Tech, Engineering, & Math - **Ladpha Teawdeswan** - Mechanical Property and Design of Multi-Material Gyroid Structures Made by Additive Manufacturing

PEOPLE'S CHOICE SPECIAL RECOGNITION AWARDS:

- Emphasis on Interdisciplinary Collaboration - **Jack Crowley & Matt Devries** - Microtonality in MIDI
- Equity Serving Research or Creative Activity - **Mercy Kibet** - The State of Black Maternal Health in Colorado
- Impact in the Denver Metro Region - **Ruth Mekonnen** - "Who Bears the Cost?": North Denver Environmental Justice Report & ArcGIS StoryMap
- Innovative Use of Technology - **Iman Salhi, Milka Tesfazion, Santiago Lanchipa Meija, & Anshu Lamichhane** - Computational Examination of Thiolate Protected Gold Nanoclusters Use for Syngas Production

PRESIDENT'S SUSTAINABLE SOLUTIONS CHALLENGE AWARDS:

- Policy, Economics, Community - **Chloe Tan** - Implications of U.S. Immigration Restrictions on Medicare
- Sustainability in Our Environment - **Natasha Pember** - The Use of Honeybees (Apis mellifera) and Hive Products for Biomonitoring of Superfund Sites in Denver, CO, USA
- Materials & Technology - **Trevor Walke**r - Geometric Mechanics of Hypar-derived Metamaterials
- Disparity, Parity in The Arts - **M. Bryn Brody** - A Tint of Gold: Mapping a TikTok Sound
- Disparity, Parity in Health & Wellness - **Kelly McCray & Richard Humbach** - Barriers to Mental Health Services for Minority-Identified Service Members: Comparison to Non-Minority Service Members and Associations with Marital Satisfaction
- Student Success - **Desiree Starzyk** - Metacognitive Awareness in College Chemistry

UNDERGRADUATE MENTOR OF THE YEAR WINNER:

- **Jeffrey Knight, PhD** - Chemistry

UNDERGRADUATE MENTOR OF THE YEAR TOP NOMINATIONS:

- **William Adams** – Visual Arts
- **Benjamin Greenwood, PhD** - Psychology
- **Woonghee Lee, PhD** - Chemistry
- **Carly Leonard, PhD** - Psychology
- **Michael "Bodhi" Rogers, PhD** - Physics

Thank you to all the Presenters, Mentors, Reviewers, and Volunteers for a fantastic 2023 RaCAS event!

RACAS 2023 ABSTRACTS

Alphabetical by Title

3D Laser Scanning Elbow Joint Surfaces to Compare Surgical Techniques
Franklin Rojas*, Natural & Physical Sciences*
Mentor: Michael Rogers

Abstract:
This project compares the amount of visible elbow joint surface area from two surgical approaches. 3D laser scans of the surgical area on cadaveric arms were gathered using an Artec Spider laser scanning and processed in Artec Studio 17 software. A mesh was created from point cloud data and used for surface area measurement. Twenty samples were scanned, processed, and measured. Observing and comparing the samples, results show that one approach reveals more of the radial head surface area. This difference may be due to the limitation of the laser scanner not being able to record "see" all of the bone surface in one technique versus the other.
https://symposium.foragerone.com/2023-racas/presentations/56591

A Conflict of Interest
Zi Dinaro, Vicky Vien*, Arts & Media*
Mentor: Andrew Bateman

Abstract:
A Conflict of Interest analyzes the complex ways trauma can affect individuals and how medical professionals (who are meant as a means for guidance) can manipulate these affected individuals. Our project emphasizes the necessity for proper mental health outreach and resources.

What is really going on in Matthew's mind may not accurately reflect what is happening in the world truthfully, as is the case with most mental illnesses. We utilized metaphorical imagery in order to emphasize the distance between what is going on in Matthew's reality in light of the "real world".

Emma's perception is a dichotomy between the real world and what Matthew has been experiencing since his loss, a broken and fragile mind bereft of the will to forgive.

The danger in the friends of Matthew, Mary and Jack, lie in their encouragement of Matthew's hatred. Without somebody to step in and quiet Matthew's growing restlessness, this violence overcame him. This film takes a stance that we must be aware of and against the act of encouraging hatred and vitriol towards others.
https://symposium.foragerone.com/2023-racas/presentations/56584

Adverse Childhood Experiences and Maladaptive Daydreaming: Predictors for Ethereal Paracosms
Lauren Moment*, Social Sciences & Humanities*
Mentor: Erik Oleson

Abstract:
Maladaptive daydreaming (MD) is an under-researched psychological condition affecting people in all countries and ages. Researchers describe the phenomenon as an escape into a paracosm, an inner fantasy world created by dreamers with elaborate plots, characters, and personalities that can become so immersive that the sufferer confuses fantasy with reality, spends hours, or even days, in a dissociative state, and neglects relationships, academics, and occupational tasks. These paracosms can be anxiety-reducing or dark depending on the patient's

mood and circumstances. Although the characters and plots can benefit the patient's mood, hours spent daydreaming can be distressing.
https://symposium.foragerone.com/2023-racas/presentations/56463

A Paleoecological Analysis of Late Holocene Megafires and Forest Response in the Diverse Klamath-Siskiyou Ecoregion
Micah Rogers, *Natural & Physical Sciences*
Mentor: Christy Briles

Abstract:
In 2020 and 2021, megafires accounted for over 62% of area burned in California and Oregon. Megafires are commonly defined as extreme fire events which burn over 100,000 acres. Understanding the response of forest vegetation communities to megafire events is critical to forest conservation in the face of increasing frequency, size, and severity of wildfires in the Western U.S. Fire and forest management goals often emphasize restoring historical conditions; however, baselines often lack a perspective of long-term trends in shifting climate, fire regimes, and vegetation composition. Paleoenvironmental proxies found in lake sediments (e.g., pollen and charcoal) can provide data from thousands of years in the past, allowing for an extended historical account of forest and fire dynamics. Fire is an integral ecological component in the Klamath-Siskiyou Ecoregion (KSE) of Southern Oregon and Northern California; however, the historical prevalence of megafires and their long-term ecological impacts remain relatively unknown. Additionally, the steep west-to-east precipitation gradient of the KSE is hypothesized to contribute to variance in forest resiliency, however, no analysis to date has examined this. This work expands upon previous studies by creating the first fine-scale analysis of individual fire events using pollen and charcoal records from sediment cores along a precipitation gradient and filling a gap in data along the precipitation gradient. This research documents the frequency of and forest resiliency to megafires in the past 2000 years across the west-to-east precipitation gradient, ultimately increasing the understanding of megafire impacts on forest resiliency in the KSE.
https://symposium.foragerone.com/2023-racas/presentations/56524

A Potential Cure for Corneal Melting Disease: Matrix Metalloproteinase-Deactivating Contact Lenses
Ema Arai, *Natural & Physical Sciences*
Mentor: JungJae Lee

Abstract:
Corneal melting, the uncontrolled degradation of the cornea, is a debilitating condition that can lead to vision loss. Interestingly, studies have found that patients with corneal melting present with elevated levels of matrix metalloproteinases (MMPs) in the corneal tissue. MMPs are zinc-dependent enzymes that play a role in tissue breakdown. Due to their dependency on zinc, MMPs can be inhibited with a chelating agent that binds to the zinc ion in their active site. Thus, potential treatment options for corneal melting include MMP inhibitors, but they tend to be nonspecific and can cause unwanted side effects as they are injected into the bloodstream. As of now, there is no cure for corneal melting. In this project, we propose a zinc-absorbing hydrogel that can eventually be turned into a contact lens. This hydrogel absorbs zinc to deactivate MMP enzymes to act as a potential cure for corneal melting disease. Unlike MMP inhibitors, contact lenses allow for a targeted application with minimal side effects, as chemicals are not released into the bloodstream. A known zinc chelating agent, ethylenediaminetetraacetic acid (EDTA), was conjugated to poly(2-hydroxyethyl methacrylate) (pHEMA), the primary material in commercial contact lenses, to create hydrogels. In addition, porous and nonporous hydrogels were made and compared. Because porous hydrogels have a larger surface area, it was hypothesized that the zinc-absorbing capacity would be greater than the nonporous hydrogels. Results showed that porous EDTA-conjugated hydrogels selectively removed zinc ions from a physiological buffer in a dose and time-dependent manner. However, EDTA did not increase the zinc absorption of nonporous hydrogels. This is likely due to the difference in the conditions for making the porous and nonporous hydrogels. More experimentation is needed to address the discrepancies in the data.
https://symposium.foragerone.com/2023-racas/presentations/56511

A Tint of Gold: Mapping a TikTok Sound
Bryn Brody*, Arts & Media*
Mentor: Margaret Woodhull

Abstract:
A year and a half after Nadia McGee uploaded a poem about the unique power of both brown eyes and blue eyes, New York actress Christi Steyn recited the poem on TikTok. Soon after, Salish member Tia Wood dueted Steyn's original sound. Within two years, TikTok creators around the world had dueted, stitched, or reacted to Steyn's original sound. Women, men, and nonbinary content creators from diverse social and geographic locations participated. Their eye color, skin color, and linguistic background varied greatly. As the sound moved from Steyn, the blue-eyed blonde South African woman who created it, to Tia Wood, the brown-eyed Indigenous woman who first dueted it, the meaning of the sound subtly changed. Each additional creator, acting as a cyborg being, attached their individual embodied reality to the existing chain of code, imbuing the code with new interpretations. But in the expansive world that is cyberspace, what work can one small piece of visual culture do, especially when confined to short video clips? For this research, I apply Black and postcolonial feminisms to a visual culture reading of the TikTok sound and the content creators who use it. I analyze how meaning is created and altered by each additional TikTok video. Using both quantitative and qualitative methods, 130 responses to Steyn's original video were collected. The data were then mapped using physical locations to determine where the sound had traveled. When cultural identities, such as Indigenous Nation membership, and languages were added to the map, a pattern emerged. While the presence of capitalism problematizes an easy reading of creator intent, it was hypothesized that TikTok can be a powerful medium for challenging social hierarchies through performances of racialized gender with a unifying, liberatory effect for subaltern populations.
Keywords: Social media; TikTok; Cyberspace; Beauty standards; Social hierarchy; Power dynamics; Visual culture; Feminism; Postcolonial
https://symposium.foragerone.com/2023-racas/presentations/56576

A Vegan Diet As A Treatment For Inflammation For Rheumatoid Arthritis Patients "Let food be thy medicine and medicine be thy food" – Hippocrates
Danna Carroll*, Biomedical Sciences*
Mentor: Kristin Sturm

Abstract:
Rheumatoid Arthritis (RA) is an autoimmune inflammatory disease that attacks healthy cells, causing inflammation in certain joints of the body, multiple at times. Early diagnosis and treatment are crucial to reducing inflammation and pain and preventing joint damage. Common treatments for RA consist of medications, occupational/physical therapy, and lifestyle changes (eg, exercise, diet). In severe cases, surgical treatment can also be considered. Before resorting to aggressive treatments, it is important to explore lifestyle changes, such as diet, to reduce inflammation. It is important to reduce inflammation to stop joints from eroding and degrading when treating RA. Certain foods such as grilled, boiled, or fried meat/food produce (AGEs), Fatty foods (omega – 6 fatty acids), sugars/refined carbohydrates (realizing cytokines), gluten, preservatives/flavor enhancers (MSG), and alcohol (containing resveratrol) all generate inflammatory reactions. Currently, changing someone's diet to a vegan, gluten free diet is not a common approach for RA treatment due to lack of empirical evidence showing that diets can effectively treat RA. Research conducted by experts in the field explored the notion of a vegan diet treating RA symptoms compared to a control/placebo group that maintained their diet. By doing a systematic review of existing research, I will reveal results that indicate the merit of a vegan diet in treating RA prior to or in conjunction with other forms of treatment.
https://symposium.foragerone.com/2023-racas/presentations/56750

A-SIMA: Advanced-Support for Interactive Metabolite Analysis with 2D NMR
Abigail Chiu*, Biomedical Sciences*

Mentor: Woonghee Lee

Abstract:
Metabolomics is the study of metabolites, which are small molecules involved in various biological processes, such as cell signaling, metabolism, and energy production, to gain insights into an organism's physiological state. It has numerous potential applications, including discovering biomarkers for diseases, identifying drug targets, and advancing cancer research. The two primary methods for analyzing metabolites are Nuclear Magnetic Resonance (NMR) spectroscopy and Mass Spectrometry (MS). NMR-based methods are more reproducible and non-destructive than MS-based methods, but their lower sensitivity is a concern. To address this issue, 2D ^{1}H ^{13}C Heteronuclear Single Quantum Coherence (HSQC) NMR experiment can be used to identify and differentiate overlapping peaks. However, the process of identifying unknown metabolites using HSQC data is traditionally time-consuming and requires manual effort as the user would have to manually individually compare their unknown to many standard compounds' HSQC data to find its identity. There are existing programs that help with the process, but they have limitations in functionality, and there aren't any options that allows users to gain control over the automated process. This project aims to develop a new computational method to automate the comparison of 2D ^{1}H ^{13}C HSQC NMR spectra to identify unknown metabolites, with the option for further analysis. The graphical user interface would allow users to group peaks that are likely from the same compound and query against the Biological Magnetic Resonance Bank database. The output will include likelihood values for each candidate, allowing users to efficiently and effectively identify unknown metabolites via a novel predict-and-confirm method. Additionally, because metabolite data are usually large and complex, the program will include an option incorporates multivariate dimensions reducing technique while maintaining variance, Principal Component Analysis. With these features, A-SIMA will provide a powerful tool for metabolomics research and facilitate the discovery of new biomarkers and drug targets.
https://symposium.foragerone.com/2023-racas/presentations/56644

AHNA: Automated Homomer Structure by NMR
Karen Pham*, Natural & Physical Sciences*
Mentor: Woonghee Lee

Abstract:
Nuclear Magnetic Resonance (NMR) spectroscopy is a powerful technique for the determination of protein structures and dynamics, with detailed information about their fold, orientation, and intermolecular interactions. Understanding the three-dimensional structure of homodimers is crucial for elucidating their biological functions and developing drugs that can modulate their activity, but determining their structures is a challenge be difficult to distinguish between the two identical subunits and determine their relative orientations. Recent advancements in Cryo-EM and NMR spectroscopy have determined a multitude of homodimer structures, but there's still limitation depending to proteins' dynamics and size. Using AHNA (Automated Homomer Structure by NMR), we can compute the lowest energy homomer conformation from monomer data (i.e., NOE, RDC, HBDA, and H-Bond) which can address the issue of predicting larger homodimer structures and visualize there dynamic structures.
https://symposium.foragerone.com/2023-racas/presentations/56666

American Sign Language Signs as a Neurodevelopmental Intervention for Hearing Children with Congenital Heart Disease
Maya Hunter*, Social Sciences & Humanities*
Mentor: Trishia Vasquez

Abstract:
Background: Children with critical congenital heart disease (CHD) are at significant risk for neurodevelopmental delays, which increase with greater severity of CHD, as well as longer post-surgical hospital stay. Medically necessary interventions such as ventilation adversely affect linguistic and cognitive development by presenting barriers to oral communication. In hearing children, using select American Sign Language (ASL) signs in combination with spoken language can result in accelerated language comprehension and communication skills compared to

those exposed only to spoken language. This is thought to be related to the typical developmental progression of motor skills, such that fine motor coordination using the hands develops prior to skills involving the mouth and throat. Thus, even developmentally delayed infants often sign before they speak, and gestures may provide a neurodevelopmental advantage for children at risk for delays, such as those with CHD.

In this preliminary study, we aimed to establish the feasibility and acceptability of implementing ASL signs programmatically with children age 0-2 years in the cardiology intensive care unit (CICU) and progressive care unit (CPCU), as part of the multidisciplinary Cardiac Inpatient Neurodevelopmental Care Optimization (CINCO) program.

Methods: Twelve high-impact ASL signs were selected for this pilot program. Interactive training presentations were developed, including information about typical infant/toddler speech/language development, cardiac neurodevelopment, and the potential benefits of and opportunities for using ASL signs with infants with CHD. Two trainings were conducted via live videoconference and attended by volunteers as well as healthcare workers such as nurses and physical, occupational, and speech/language therapists. Data regarding volunteers' use of ASL signs, as well as the patients' interest and engagement when ASL signs were utilized, were collected via a Research Electronic Data Capture (REDCap) survey, completed at the end of each volunteer shift.

Results: During the three-month period following the initial training, ASL signs were utilized in 12 out of 94 (12%) volunteer interactions with children age 0-2 in the CICU and CPCU. Within these interactions, the child was engaged with the sign 92% of the time. ASL signs used included *PACIFIER, SLEEP, BOOK, MUSIC, PAIN, MORE, FINISH*, and *PLAY*. The most frequently used signs were *MORE, ALL DONE*, and *PLAY*. Additionally, in two of the 12 interactions, the patient was reported to sign back *MORE and/or FINISH*. Selected anecdotal feedback from the volunteers included: *"[Patient] responded excitedly to sign language but seemed like the first time anyone had used it with her"* and "*Used the "more" sign when playing with toys and when [patient] saw the sign they seemed so focused on it."*

Conclusions: We developed and implemented a targeted ASL intervention for young children with critical CHD, delivered by volunteers in the cardiac inpatient units. We found promising early indication of the potential impact of teaching ASL signs, demonstrated by patient attentiveness and reciprocity to ASL. Next steps include integrating this ASL training into the CINCO volunteer onboarding for all incoming volunteers and assessing the impact of ASL intervention on cognitive and linguistic short-term outcomes.
https://symposium.foragerone.com/2023-racas/presentations/56712

An Apple a Day Does Not Keep the Flies Away: Is the Gut Microbiome Associated with Host Range Expansion in a Fruit Fly?

Gabrielle Dudek*, Natural & Physical Sciences*
Mentor: Gregory Ragland

Abstract:
Microorganisms living in the digestive system, the gut microbiome, are critical for human health, and likewise are important for survival and persistence of animals in the wild. Changes in diet influence the microbiome, and conversely the microbiome may facilitate or inhibit digestion of different diets. This study compares the gut microbiomes of two Denver populations of apple maggot flies (*Rhagoletis pomonella)*, one that feeds on the native host hawthorn fruits (*Crataegus mollis*) and one that feeds on dolgo apples (*Malus baccata*) and may pose a threat to commercial apple growers. While these flies have not yet threatened commercial apple growers in Colorado, they do pose a threat to growers in the northeast, midwest and pacific northwest United States and southeastern Canada. The significance of this project includes important advances in our understanding of what biological mechanisms may allow insects to expand their host range to include plants of agricultural importance. This study is motivated by observations of fruit flies and other insects readily expanding their host range to attack crops when either the plants are newly introduced or when the insects move to new locations. The goal was to determine if shifts in the microbiome are associated with the ability of these fruit flies to attack new types of fruit. Using methods developed for a Course-based Undergraduate Research Experience (CURE) on soil microbiomes, gut tissue samples were dissected from the flies and DNA was extracted and amplified for genetic sequencing. I used metagenomic methods implemented in the program QIIME to determine species composition and diversity of the microbial communities,

and I describe how these results inform our understanding of the range of food types that can be exploited by fruit flies. The results of this study may inform efforts to predict, and potentially limit fruit fly infestations in commercial orchards.
https://symposium.foragerone.com/2023-racas/presentations/56645

An Endeavor Into a New World of Art
Peter Krausa*, Arts & Media*
Mentor: William Adams

Abstract:
From the point of complete inexperience in visual arts, the tidal wave of self-doubt and perfectionism can easily consume newcomers. Through pushing past creative boundaries beyond Music into visual arts, I was able to not only find self-actualization and confidence in my abilities, but also compound my experience and enrich my time as a music student. The process of working with colorful personalities, and increasingly novel tasks undergone has prepared me not only for the continued pursuit of my own Musial aspirations, but also prepares me for the aspects of creation that can't be replicated. As a business student, my time in the program and with Bill was profoundly useful in that I was able to grow my communication skills, work in a professional environment with deadlines, expand my creative thought, and develop a growth mindset toward challenging obstacles of any kind. As my time concludes, I feel motivated to continue pursuing new paths of engagement and creativity behind what I once thought possible, and in the world of music having further knowledge in any aspect of art is an incredible boost for recognition and the development of a solid reputation. The pursuit of challenging and frightening new jobs is one that deters, but ultimately should encourage as when we as people expand out, not only are there legitimate cognitive benefits, but we transcend what we thought was once possible and shackled to.
https://symposium.foragerone.com/2023-racas/presentations/56747

ASO, You Want To Treat Cancer? Treating Triple Negative Breast Cancer With Antisense Oligonucleotides Treating Triple Negative Breast Cancer With Antisense Oligonucleotides
Gabriela Padilla*, Biomedical Sciences*
Mentor: Aaron Johnson

Abstract:
Approximately one in eight women in the United States will be diagnosed with breast cancer in their lifetime. 10-15% of all breast cancer can be classified as triple-negative breast cancer (TNBC). TNBC is considered a hard-to-treat cancer due to its lack of three receptors that are commonly targeted by cancer drugs.
A link between cancer and aberrant expression of long non-coding RNAs (lncRNAs) has been found, in which these up or down-regulated lncRNAs can cause the cancer cells to become more aggressive. In some TNBC cases, a lncRNA called Hox Transcript Antisense RNA (HOTAIR) is upregulated and drives the cancer by turning tumor suppressor genes off, increasing the proliferation and metastasis of the cancer. HOTAIR has been found to have N6-Methylaednosine (m6A) modifications that regulate its function. One m6A site at A783 on HOTAIR has been shown to be essential for HOTAIR's function.
Previous studies show that mutating this site from adenine to uracil is enough to stop the nuclear m6A reader YTHDC1 from binding to the m6A site, reducing its ability to interact with chromatin and repress its targets. I treated TNBC cells that over-express HOTAIR with Ansti-sense Oligonucleotides (ASOs) that target the A783 m6A site in an attempt to prevent its function on HOTAIR. Preliminary results suggest that ASOs do slow cancer cell growth and invasion. Ultimately, if ASOs are shown to effectively block HOTAIR's ability to promote cancer aggressiveness, they may have therapeutic potential.
https://symposium.foragerone.com/2023-racas/presentations/56472

Automated Chemical Shift Assignments of MAS Solid-State NMR Spectra of Complex Protein Systems by ssPINE/ssPINE-POKY

Andrea Lopez*, Natural & Physical Sciences*
Answer: Woonghee Lee

Abstract:
Nuclear Magnetic Resonance (NMR) is a crucial method in structural biology for studying complex biological structures with high resolution. Solid-state NMR (ssNMR) allows for the study of large, structurally complex macromolecules due to low solubility. Despite this advantage, computational tools for analyzing ssNMR data lag those for solution NMR. To streamline the process, we developed the "ssPINE" automated algorithm for ssNMR spectra analysis. The "ssPINE-POKY" graphical user interface simplifies using ssPINE, requiring only a few clicks to run a job and import results.
https://symposium.foragerone.com/2023-racas/presentations/56706

Barriers To Mental Health Care Among The Latino Community

Gabriela Peralta Reyes*, Social Sciences & Humanities*
Mentor: Hyeyoung Oh Nelson

Abstract:
According to the National Alliance on Mental Health Illness, “more than half of Hispanic young adults ages 18-25 with serious mental illness may not receive treatment” (National Alliance On Mental Illness, n.d.). Consequently, this study proposes to analyze the barriers Latinx adults, ages 18-35, encounter when taking care of and/or maintaining their mental health. We will employ qualitative research methods, specifically semi-structured interviews, to determine if this population is experiencing mental health care barriers. Interviews will be audio-recorded and transcribed. Interview transcriptions will be input into Atlas.ti, where we will conduct a line-by-line abductive coding of the data. Themes for coding will include self-assessments of mental health, mental health care practices and/or services sought out, and barriers to receiving mental health care. Ultimately, we hope that our findings contribute to our understanding of Latinx mental health care and provide a basis for the development of new interventions to help this population access mental health services.
https://symposium.foragerone.com/2023-racas/presentations/56510

Barriers to Mental Health Services for Minority-Identified Service Members: Comparison to Non-Minority Service Members and Associations with Marital Satisfaction

Kelly McCray, Richard Humbach*, Social Sciences & Humanities*
Mentor: Dr. Elizabeth Allen

Abstract:
Military service involves unique challenges such as deployments that may impact service members (SMs) and their families. Kim et al. (2010) found both high levels of mental health challenges (MHCs) among active-duty SMs and substantial stigma-related barriers to seeking help, including a fear of their unit leadership treating them differently and/or blaming them for their MHCs. Racism and discrimination may exacerbate concerns regarding these fears. For example, Asian-American service members who endorse stigma as a barrier may be less likely to seek treatment than other ethnic groups (Chu et al., 2021). This study examines whether minority-identifying SMs endorse fear of professional retribution from their leadership at greater rates than non-minority SMs, and whether such fear is associated with lower levels of marital satisfaction for SMs and their partners.
The hypothesis was tested using a sample of married couples from the Army Marriage Project (AMP), consisting of male SMs and female partners (N = 396 male, 389 females). SMs reported on their fear of retribution as a barrier to mental health services, and both partners reported their marital satisfaction. No significant difference (p = .08) was found between the scores for fear of retribution among minority-identifying (M = 2.11, n = 127) and non-minority SMs (M = 2.35, n = 269). There was a significant negative correlation (ρ = -.112, p = .026) between the fear of retribution score and marital satisfaction for male SMs. This was not significant (p = .199) for non-minority SMs, and significant (ρ

= -.208, p = .019) for minority-identifying SMs. No significant correlations were identified between the female partners' marital satisfaction and her partner's fear of retribution score.
These results may be affected by the nature of the sample (volunteers for a study on a marital intervention) who may be more comfortable with intervention and self-disclosure.
https://symposium.foragerone.com/2023-racas/presentations/56582

Biliteracy Development: A preliminary analysis of Code Switching/Translanguaging in Bilingual Writing.
Luz Moreno*, Social Sciences & Humanities*
Mentor: Adriana Alvarez

Abstract:
Bilingual Education has been a highly controversial subject within the realm of education. While some argue against dual/multilingual instruction claiming an inherent source of confusion for students, others cite the power behind multilingualism in an increasingly diverse environment in schools, workplaces, and communities.

As there is much discourse surrounding Bilingual Education, there is an increasing ground for research. Although conversation in the past decades has been substantial, there remains an importance of highlighting its realities in practice.

The research I am assisting in seeks to observe the progression of students in Spanish and English bilingual education throughout a school year.

With a focus on metalinguistic awareness, we look for the connections between the two languages in students' work and how the ways in which they aid in advancements within both languages. A qualitative study, we code students' writing to contribute to an understanding of patterns in the transfer of language. In addressing these elements in the reading and writing of students presently studying in the realm of Spanish/English education, context can be provided into the development of skills in both languages concurrently.

This research hopes to demonstrate the relation between biliteracy and modeling/reflection teacher practices and guidance, as well as gain insight into whether children learn two languages simultaneously or in isolation.

This project closes in on a major point brought up against Bilingual Education and exemplifies a major component of education in any language: literacy development.
https://symposium.foragerone.com/2023-racas/presentations/56672

Building user-friendly R functions for genomics research
Makena Avichouser*, Tech, Engineering, & Math*
Mentor: Audrey Hendricks

Abstract:
Genetic and environmental factors determine a person's traits. Using methods like linear regression, we can model the likelihood of developing traits using known genetic and environmental predictors. Factors not modeled in a regression, such as unidentified genetic elements and challenging to measure environmental contributors, comprise the error term or residual. Investigating patterns in the residual could potentially reveal hidden or unmodeled variables, namely difficult to measure environmental factors such as systemic and structural determinants of health. Utilizing deep phenotyping gives us the opportunity to treat each trait as a single observation of the hidden structures within our residuals, giving us many more estimates of these latent variables. Our simulations have shown that unsupervised learning on the residuals of many univariate and multivariate regressions over traits and measured genetic and environmental factors can discover latent environmental variables. We developed a series of functions to efficiently and easily implement the entire simulation and method workflow, including simulating genetic and environmental factors, calculating the traits and residuals, and running k-means clustering and principal component

analysis. With a focus on simple replication and ease of use, I have revised the existing functions into a more user-friendly software for smoother implementation. The improved functions and workflow will enable a more in-depth evaluation of the current method and development of new techniques to identify hidden environmental variables from high-dimensional datasets.
https://symposium.foragerone.com/2023-racas/presentations/56697

Cadmium and Zinc Tolerance in *Suillus brevipes*
Maham Malik, *Biomedical Sciences*
Mentor: Sara Branco

Abstract:
Soil metal pollution is prevalent in the American West and can negatively affect metabolism, growth, and reproduction, often leading to death. Some fungal species are able to tolerate high levels of soil metals, however it is unclear whether the species *Suillus brevipes,* an obligate symbiotic fungus associated with pine trees and widespread across the Rocky Mountains, is able to tolerate high concentrations of zinc and cadmium. We set up growth assays to test cadmium and zinc tolerance in *S. brevipes* collected in Colorado. We expected *S. brevipes* isolates originating from metal contaminated sites to grow better in high metals than isolates collected from areas with low pollution. We found *S. brevipes* displays large variation in metal tolerance, with some isolates showing much higher zinc and cadmium tolerance than others. We also found that polluted sites have no correlation to the tolerance of metal in the growth of S. brevipes. Our results contribute to better understand fungal metal tolerance and pave the way to develop strategies for reforesting metal contaminated sites.
https://symposium.foragerone.com/2023-racas/presentations/56719

Can dopamine receptor signaling mimic the effects of exercise and enable stress resistance?
Lareina Alvarez, *Biomedical Sciences*
Mentor: Benjamin Greenwood

Abstract:
Depression and anxiety are two of the most common mental health disorders in the world and are often precipitated by stressful life events. In rodents, behaviors similar to depression and anxiety are observed following exposure to inescapable stress (IS). An example of this type of behavior includes social avoidance. Chronic exercise (in the form of wheel running) protects rats from behaviors induced by IS, similar to how exercise can protect humans against stress-related disorders. During IS, serotonin neurons within the dorsal raphe nucleus (DRN) are hyperactive, which subsequently contributes to anxiety-like behaviors. Wheel running prevents the anxiety-like effects of IS by constraining the activity of the DRN, but the mechanisms by which exercise constrains the DRN are unknown. Wheel running increases dopamine (DA) release and activity of DA D1 receptor-expressing neurons in the dorsolateral striatum (DLS) during stress. This is important, because D1-expressing neurons in the DLS can inhibit the DRN. The goal of this experiment is to determine whether increasing DA D1 receptor signaling in the DLS during IS can mimic the effects of exercise and prevent social avoidance produced by IS in sedentary rats. Microinjecting a D1 agonist SKF38393 into the DLS prior to IS was used to pharmacologically increase D1 signaling in adult, male Sprague Dawley rats. The design was a two x two factorial design with stress (no stress vs. IS) and drug (saline vs. D1 agonist) as factors. Preliminary results suggest that increasing D1 signaling in the DLS during IS prevents the reduction in social exploration produced by IS in sedentary rats. Further results also indicate that a D1 agonist does not prevent IS from reducing locomotor activity and it does not increase overall locomotor activity. These data suggests that DA D1 signaling in the DLS could be a novel target for increasing stress resilience.
https://symposium.foragerone.com/2023-racas/presentations/56569

Comparing Bone-Implant Interface Stresses of Transfemoral and Transtibial Osseointegrated Implants During Walking

Jake Tinsley*, Tech, Engineering, & Math*
Mentor: Dana Carpenter

Abstract:
Osseointegrated (OI) prostheses have emerged as an alternative option for patients with transfemoral (TF) and transtibial (TT) amputations to address socket-related pathologies. Unfortunately, fractures or slippage at the bone-implant interface persists in a small subset of OI patients. Interface loading is critical for short- and long-term outcomes to maintain osseointegration and bone health.
Finite element analysis (FEA) is a commonly used method for non-invasively determining stresses, which lacks subject-specific parameters. Thus, this study aimed to evaluate bone stresses at the interface of TT and TF implants in the lower limbs using patient-specific parameters.
With IRB approval, two patients (one TF, one OI) participated in motion analysis that collected whole-body kinematics and ground reaction forces during overground walking. Subject-specific musculoskeletal (MSK) models and static optimization were used to estimate muscle and joint reaction forces throughout the amputated limb stance period. FEA models of the bone-implant systems with homogeneous material properties were imported into ABAQUS. Muscle forces were applied at the corresponding origin/insertion locations of the MS model. MS-derived joint forces were applied at the distal joint, and a fixed boundary condition was applied to the proximal joint. Muscle and joint forces were updated at each time point to obtain a dynamic understanding of implant stresses. MSK and FEA-derived estimates of resultant proximal joint reaction forces were compared for validation.
The TF and TT participants' maximum stresses at the interface were 14.76 MPa and 20.27 MPa. FEA- and MSK-derived resultant proximal joint errors were 6.12% and 5.02% for the TF and TT models.
Our results demonstrate that patients with TT OI prostheses may experience higher interface stresses than TF OI during walking and provide a foundation for future work investigating underlying processes of mechanical failure in OI prostheses of the lower limbs.
https://symposium.foragerone.com/2023-racas/presentations/56611

Computational Examination of Thiolate Protected Gold Nanoclusters Use for Syngas Production
Iman Salhi, Milka Tesfazion, Santiago Lanchipa Mejia, Anshu Lamichane*, Natural & Physical Sciences*
Mentor: Emilie Guidez

Abstract:
This investigation examines the role of gold nanoclusters Au25(SPhX)18^ (-1) with varying ligands, as a catalyst for the reduction of carbon dioxide and the formation of syngas using Density Functional Theory computations. Initial computations suggested that throughout negatively charged Au25(SPhX)18^ (-1) clusters in both solvated and non-solvated environments, the cis/trans conformation of the gold clusters had an effect on the overall energy of formation. The lower the overall energy of the complex, the easier it may be for the CO_2 to reduce and form CO. DFT calculations determined HOMO-LUMO gaps and the relative energies of multiple ligands in different solvated phases. The negatively charged clusters were run due to their likelihood of being more efficient. This is attributed by the stability of the negative charge which gives rise to a closed shell. The negatively charged cluster ensured that there were free electrons that could ensure the reduction of carbon dioxide to from syngas. The cis/trans conformation of the different complexes allowed for the reaction to proceed with the overall lowest amount of energy use.
https://symposium.foragerone.com/2023-racas/presentations/56896

CU Denver Chemistry Club Demonstration Event and Involvement
Emily Irlbeck, Ally Poland*, Natural & Physical Sciences*
Mentor: Kyoung Kim

Abstract:
The chemistry club requested a grant to use on planning, organizing, and implementing activities to foster an interest in science, inform the public about fundamental chemistry concepts, and promote CU Denver chemistry opportunities/degrees. What started as on-campus events expanded to off-campus demo showings and activities at

a public school in Jefferson County. Through use of the grant, highschoolers were able to execute unique chemistry demos with undergraduate guidance, and undergraduates obtained leadership, management, and teach skills.
https://symposium.foragerone.com/2023-racas/presentations/56619

CU Denver Community of Practice Research on OER
Joyce Lopis*, Social Sciences & Humanities*
Mentor: Ronica Rooks

Abstract:
By conducting various questionnaires such as a pretest, interview, and post-test, this study aims to explore the use of open-ended resources. Descriptive Analysis will be used to examine surveys and thematic analysis for the interview and participant observations. This material will allow us to gather information about what the participants(faculty) have learned about OER(Open-End Resources), their views on incorporating OER in their curriculum, how their students are responding to the implementation of OER—looking into participant experiences in searching for OER and evaluating the content within OER for accessibility, diversity, equity, inclusion, and social justice. A combination of quantitative and qualitative approaches was used in the data analysis and consisted of ten individuals, some of whom participated in a survey and semi-structured interview. The study was conducted as a survey, with data being gathered via pre-test; the questions consisted of how long they have been a CU Denver, their discipline, whether they are familiar with OER/ their experience with OER, and do they select their course material. Post-test that has yet to be taken by participants. Our study was a small group, so there was a small amount of data, and our results are still being collected. However, some broad themes emerged from the analysis of implementing OER: faculty believed it takes too much work to know where to get resources and dedicate enough time. Next, it would promote equality, cost savings, and lower barriers. The insights gained from this study may assist the OER community overall. There is a small amount of literature out there on OER. However, the literature on faculty using OER explores the economic Impact (Student Cost), learning impact (Student Success), student perception of OER, faculty perception of OER, and things that influence OER. These results can add to the rapidly expanding field of OER.
https://symposium.foragerone.com/2023-racas/presentations/56596

Decades of Displacement: A Generational View of the History of Auraria
Nicole Saran*, Social Sciences & Humanities*
Mentor: Lucy Dwight

Abstract:
In 1965 Denver experienced devastation when the South Platte River flooded. This flood remains the cities most expensive flood in the states history, with damage totaling over 500 million at the time, an equivalency of over 4 billion dollars today. In the aftermath of this flood the city chose to take advantage of the damage done by this natural disaster to enact plans for urban renewal. One of these plans was to construct an institution of higher education. The intention was to build on land that had recently been damaged due to flooding, which was also home to a thriving Hispanic community known as the Aurarians. The forced relocation of this community has impacted the individuals who experienced it directly as well as their families for generations. This project utilized a mixed-methods approach to collect both quantitative and qualitative data that was used to assess and measure the impact of displacement on members of the Aurarian community and their descendants. The quantitative data was collected by creating and distributing a survey, receiving 80 responses from individuals on the Auraria campus. The survey asked about individuals' awareness of the displacement that occurred on this land as well as the scholarship offered to those impacted. The qualitative data came from interviews conducted with 5 individuals spanning 3 different generations. Each individual represented a different degree of impact as well as different experiences.
This project concluded that the initial impact of the displacement was negative and touched various aspects of people's lives. It also found that utilization of the Displaced Aurarian Scholarship was not available for those directly displaced or their children. This resulted in individuals needing to self fund their college experience, which was made more challenging for some because of the displacement they faced, creating a negative view of the event. On the other hand we found that the extension of the scholarship to include all descendants has helped to change the

narrative around the displacement by creating a more sustainable environment of higher education for families that were forced to relocate. Because the scholarship is offered to descendants, those who were not able to utilize the scholarship for themselves yet experienced displacement have been able to send their children to college, creating future opportunities they may not have otherwise had.
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Design and Fabrication of a Cryostat for Determining the Effective Area of an Array of Superconducting Quantum Interference Devices
Anaida Gevorgian*, Natural & Physical Sciences*
Mentor: Martin Huber

Abstract:
The SuperCDMS SNOLAB experiment, located in the Vale Creighton Mine, utilizes extremely sensitive magnetometers to aid with the detection of dark matter particles. These magnetometers are arrays of Superconducting Quantum Interference Devices (SQUIDs). The goal of this project is to establish the sensitivity of SuperCDMS SQUID arrays to external magnetic fields. CDMS SQUIDs are designed such that they will be most sensitive to currents passing through their coils, and less to external sources. This insensitivity to external magnetic fields isn't always ideal, and can alter experimental measurements. This insensitivity will be determined by finding the effective area of the SQUID, which is the ratio of the magnetic flux coupling both through and around the SQUID loop. Understanding this sensitivity to ambient magnetic fields will influence and enhance the design of future SQUIDs. We are currently designing a cryostat (dip probe) to hold the SQUID array chip in a series of Helmholtz coils as it is inserted into a liquid helium dewar. The cryostat elements are being designed using a CAD
software called Fusion360.
https://symposium.foragerone.com/2023-racas/presentations/56630

Designing a More Efficient Altitude Compensating Rocket Nozzle
Ersel Serdar*, Tech, Engineering, & Math*
Mentor: James Nabity

Abstract:
The next generation of space exploration requires more efficient propulsion. Current rockets use bell-shaped nozzles, which lose efficiency at high altitudes due to flow underexpansion. This increases mission costs and reduces payload capacity. Multiple altitude-compensating nozzles (ACNs) have been developed as a solution. Among these, the dual bell nozzle has a simple design and is considered to be one of the best existing ACNs. The plug nozzle is another ACN that can adapt to different altitudes by moving its pintle, and recovers lost efficiency in vacuum. For this project, I developed a novel hybrid nozzle (a dual bell nozzle with a movable pintle) and compared it to the plug and dual bell nozzles. All three nozzles were 3D printed and tested at CU Boulder's Engine Test Room using liquid CO2 with a pressure of 1300 psi to simulate exhaust gases. Average thrust values and 95% CI were calculated for different chamber pressures. At lower altitudes (600 psi), the hybrid nozzle (pintle retracted) produced up to 120% more thrust than the dual bell nozzle. These results suggest that the hybrid nozzle is a more efficient alternative to existing nozzles and can improve propulsion at high altitudes, reduce cost, increase payload, and potentially move space exploration further. Future research should explore a moveable pintle to respond to pressure changes and a nozzle with smaller area ratios.https://symposium.foragerone.com/2023-racas/presentations/56573

Developing a Graphical User Interface for a Data Acquisition System for Precision Voltage Measurements of Quantum Sensors
Stephanie Howell*, Natural & Physical Sciences*
Mentor: Martin Huber

Abstract:
This data acquisition system (DAQ) is an instrument designed to control and read out a superconducting quantum interference device (SQUID) array, with multiple high-precision, low-noise analog input and output channels. This system replaces an existing multi-instrument control system whose interface was written in LabVIEW. Because LabVIEW's code does not lend itself toward efficient documentation, the current script is being written in Python and C++. At the outset of this project, the code to send and receive values between host computer and microprocessor via serial lines had already been written (firmware). The remaining task was to create a graphical user interface (GUI) on the host computer written in PyQt. The processes of this GUI are to accept user input, perform conversions on the input, send these values via a serial interface to the microprocessor, and then accept output values for data collection and graphical visualization. The project at hand involves creating a 2-dimensional "colormap" for visualization purposes. This includes: a graphing window with 3 subplots, each of which share the same x and y axes, and incorporating two dial widgets that will navigate the same point on each subplot simultaneously. Future plans for the project involve comprehensive error checks and real-time graphs.
https://symposium.foragerone.com/2023-racas/presentations/56601

Differences and Similarities in Landscape Scene Safety Ratings
Christiana Smith, *Social Sciences & Humanities*
Mentor: Carly Leonard

Abstract:
Individual judgments of safety have been a focus of psychological and criminological research pertaining to bias, crime, and trust for several years. However, little is known about differences in safety judgments in the context of environmental scenes. Here we report on the results of a preliminary experiment where participants were asked to rate an array of environmental scenes for safety on a scale of 1-7. The data collected will be used to determine which images will be used in an upcoming experiment investigating safety and criminality.
https://symposium.foragerone.com/2023-racas/presentations/56912

Disparities in the Latine Community with Rheumatoid Arthritis
Vanessa Hernandez, *Biomedical Sciences*
Mentor: Kristin Sturm

Abstract:
Latine patients with rheumatoid arthritis (RA) face serious health disparities, manifesting themselves in increased levels of pain, disability, activity limitations, and prevalence of other chronic diseases when compared to non-Latine Caucasians. Early diagnosis is vital (ideally within 3-4 months of initial symptoms) in order to begin treatment as soon as possible to slow disease progression. Latine RA patients experience a notable delay in their initial diagnosis (average time from symptom onset to diagnosis ~23 months) compared to non-Latine Caucasians and African Americans (average time from symptom onset to diagnosis ~7 months). This delay in diagnosis results in a treatment delay, leading to Latines with RA experiencing overall worse functional outcomes (e.g., earlier joint deformity; higher disability; pain levels; worse overall global health). Not only is there a gap in research investigating the reason/s Latine RA patients experience this initial delay of diagnosis, but Latines are also heavily underrepresented in RA research. To address these gaps and underrepresentation of Latines in RA research, we are initiating a research study consisting of a questionnaire (Spanish and English) that will allow us to compare information between Latine and non-Latine Caucasians and their experience with the healthcare system, disease-specific knowledge about RA, and interest in participating in research. We hope that this will allow us to better understand the social risk factors that contribute to the health disparities Latines with RA encounter as well as providing more research opportunities and information to the Latine community. Results from this study will provide us with enough insight to apply for the CCTSI Community Engagement Pilot Grant Program, allowing us to address some of the identified barriers within the Latine RA community.
https://symposium.foragerone.com/2023-racas/presentations/56702

Do Differences in Partners' Experience of Racial Discrimination Relate to Relationship Satisfaction?
Julianne Hoang, *Social Sciences & Humanities*
Mentor: Elizabeth Allen

Abstract:
As the United States population is becoming more racially and ethnically diverse, so have its couples and marriages. Previous studies have suggested that racially/ethnically non-homogamous couples experience more negative relationship outcomes and less relationship satisfaction than homogamous couples (Brown et al., 2019; Bratter & King, 2008; and Wang et al., 2006). Additionally, prior studies have shown that experiences of racial discrimantion negatively impact mental health (Noh et al., 2007; Kwame, 2006; Siddiqui, 2022; and Barr et al., 2022). The purpose of this study is to further investigate how differences in experiences of racism and discrimination (ERD) between two partners are associated with relationship satisfaction. We hypothesize that (a) non-homogamous couples will have a greater ERD discrepancy than homogamous couples and (b) that higher ERD discrepancies in non-homogomous couples will be associated with lower relationship satisfaction. We conducted our analyses on a sample of 194 couples from Denver. Eighty-six of these couples were homogamous in their race/ethnicity, and 108 of these couples were non-homogamous. A one tailed T-test was used to analyze discrepency of ERD scores. It was found that ERD discrepancies in non-homogamous couples (M=1.06) were significantly higher than those of homogamous couples (M=0.84) (t(170)= -1.84, p= 0.03), supporting the first hypothesis. A correlation was also run to test the association between ERD discrepancies and relationship satisfaction in non-homogenous couples. Results of this analysis reflect no significant association between ERD discrepancies and relationship satisfaction among non-homogamous couples (r= .06, p= .50). With the increasing racial and ethnic diversity of couples in the United States today, mental health and marriage therapy professions are more likely to treat these types of couples. Therefore, understanding unique circumstances these couples face can help these professionals better treat these couples.
https://symposium.foragerone.com/2023-racas/presentations/56647

Does dopamine signaling protect against stress-induced exaggerated fear?
Miles Dryden, *Biomedical Sciences*
Mentor: Benjamin Greenwood

Abstract:
Stress-related disorders, such as anxiety and depression, are among the most common mental health disorders in the world. Inescapable stress is a predisposing factor for the development of anxiety disorders. Inescapable stress sensitizes serotonin neurons in the dorsal raphe nucleus (DRN). This DRN sensitization results in several behavioral consequences, including exaggerated fear responses. For example, when exposed to a mild foot shock, rats exposed to prior inescapable stress exhibit exaggerated levels of freezing. This reflects a more intense fear response from the rat, a behavioral pattern similar to human anxiety. Exercise reduces anxiety symptomology in humans, and similarly, protects rats against the consequences of inescapable stress. The cellular pathway through which exercise constrains this exaggerated fear response is poorly understood, but evidence suggests it involves activating D1 dopamine receptor-expressing neurons in the dorsolateral striatum (DLS). Exercise both potentiates dopamine efflux in the DLS and increases the activation of D1-expressing neurons in the DLS during stress. It is hypothesized these DLS neurons in-turn constrain the DRN, preventing the behavioral consequences of inescapable stress. If DLS D1-signaling is important for the ability of exercise to prevent stress-induced exaggerated fear, then increasing D1-signaling may be able to replicate this effect of exercise in sedentary rats. To determine this, we pharmacologically enhanced D1-signaling in the DLS prior to stress. A two-by-two experimental design with drug and stress as factors was utilized. Male rats received an intra-DLS microinjection of either D1 agonist (SKF38393) or saline prior to stress. For stress, rats either received inescapable tail-shock or were left in their home cages undisturbed. Preliminary data suggest the D1 agonist potentially protects against the development of exaggerated freezing following inescapable tail-shock without affecting locomotion. These data suggest D1-signaling in the DLS could mimic the effects of exercise and be a novel target for promoting stress resilience.
https://symposium.foragerone.com/2023-racas/presentations/56694

Does size matter? Phenotypic indicators of seed viability in *Pinus flexilis*
Chariss Thexton, Kyle Bergenthal, *Natural & Physical Sciences*
Mentor: Diana Tomback

Abstract:
Limber pine (*Pinus flexilis)* is a stress-adapted conifer, widely distributed at high elevations east of the Continental Divide in Rocky Mountain National Park and across the Colorado Front Range. Populations of *P. flexilis* and related white pine species are threatened by white pine blister rust, a disease caused by the non-native fungus *Cronartium ribicola*, as well as recent mega-fires in Colorado. Growing seedlings is important for limber pine restoration, and recognizing predictors of viability is crucial to increasing germination success for these efforts. Seed mass or length has been observed to have a significant influence on germination success for several coniferous species, although these variables may be more closely linked to seed fill rate. The relationship between seed length and weight to viability in limber pine seeds has yet to be explored. We examined seed size as a predictor of viability in filled seeds where viability was determined using standard tetrazolium dye tests. Preliminary analyses found that seed length, seed weight, and embryo length were not predictors of viability for limber pine. We are continuing to examine these variables across a wider sample of *P. flexilis* seeds. This approach sheds new light on phenotypic indicators of reproductive potential.
https://symposium.foragerone.com/2023-racas/presentations/56634

Effect of Cognitive Behavioral Therapy and Adverse Childhood Experiences in the Balance and Empowered EaTing (BEET) in Diabetes Study
Nhi Nguyen, *Natural & Physical Sciences*
Mentor: Rachel Johnson

Abstract:
The Balanced and Empowered EaTing (BEET) in Diabetes Study investigated the effectiveness of a cognitive behavioral therapy (CBT) intervention (BEET Diabetes Program) on disordered eating behaviors (DEB) in adults with type 2 diabetes (T2DM). This secondary analysis examined whether adverse childhood experiences (ACEs) impact the intervention's effectiveness. Participants (N = 28 low [0-1] ACEs, N = 25 high [2+] ACEs) self-reported mental and physical health and eating behaviors before and after the intervention. The high ACE group had worse mental health and more severe disordered eating scores at baseline. After the intervention, high ACE participants exhibited more significant reductions in diabetes eating problems and disordered eating symptoms compared to the low ACE group. The study emphasizes the need to address disordered eating behaviors in type 2 diabetes management and the impact of ACEs on these behaviors.
https://symposium.foragerone.com/2023-racas/presentations/56495

Effects of Cholesterol on Membrane Binding by Synaptotagmin 7 C2 Domains
Vrishank Bikkumalla, Ariel Matthews, *Natural & Physical Sciences*
Mentor: Jefferson Knight

Abstract:
Synaptotagmin-7 (Syt-7) is a calcium-dependent membrane binding protein that is involved in insulin secretion. Defining factors involved in Syt-7 membrane binding is important for understanding basic endocrine and neuronal biology as well as disease pathology. Syt-7 contains two C2 domains that bind membranes with strong calcium sensitivity. It remains uncertain how specific lipids in the cell affect Syt-7 membrane binding. Here, we present molecular dynamics simulation data which suggests that cholesterol may preferentially accumulate at the sites of C2 domain membrane interaction. Additionally, we used stopped flow and equilibrium fluorescence assays to measure kinetics of release and relative calcium dependence in liposomes with and without cholesterol. Our preliminary results indicate an increased dissociation rate when cholesterol is removed, as well as an increased calcium concentration to reach full membrane binding. Results will be presented for ongoing experiments with Syt-7 C2A,

C2B, and C2AB domains. Overall, the study will improve our understanding of the factors that control the membrane affinity and calcium sensitivity of Syt-7, potentially leading to a better understanding of endocrine disease pathology.
https://symposium.foragerone.com/2023-racas/presentations/56638

Effects of Frequency-Dependent Feedback Electronics on Relaxation Oscillation Pulses in a Hysteretic SQUID
Lauren Luna*, Natural & Physical Sciences*
Mentor: Martin Huber

Abstract:
Relaxation oscillations are a phenomenon that occur in hysteretic superconducting quantum interference devices (SQUIDs) that cause the SQUID to rapidly transition between the superconducting and voltage states. Relaxation oscillations have been observed in a novel type of SQUID, the SQUID-on-tip (SOT), that occur at lower frequencies than what theory predicts. More information is needed to investigate the underlying cause to improve performance but further research on this phenomenon has been complicated by the interactions between SQUID signals and the frequency-dependent feedback electronics that are used to measure them. In this study, two different sets of frequency-dependent feedback electronics are used to measure the fall time constants, rise time constants, and amplitudes of individual pulses that comprise the relaxation oscillations in a single hysteretic SQUID. The results are compared here, and the qualitative and quantitative information gathered will aid in future research regarding this phenomenon.
https://symposium.foragerone.com/2023-racas/presentations/56649

Effects of Pine Woodsmoke Particles on a Lung Alveolar Type II-like Cell Line
Annie Mora*, Biomedical Sciences*
Mentor: Alison Bauer

Abstract:
Wildfires are unpredictable and uncontrollable natural phenomenon's. As the vegetation combusts, a significant amount of particulate matter is released into the air. Particulate matter has serious health impacts when inhaled and can worsen health conditions such as asthma and COPD. Recent climate changes provide ideal conditions for more wildfires, and thus it has become increasingly important to study the potential toxic effects of woodsmoke particulate matter (WSP) exposure. *We hypothesize that treatment of lung type II epithelial cells with pine WSP will increase adverse cellular effects*. For our studies, we used A549 cells that are a human alveolar type II-like tumorigenic cell line exposed for 24 h to pine WSP generated at the CSU Center for Energy Development and Health. These pine WSP are a surrogate for wildfire smoke exposure. We used MTS and LDH assays to evaluate cytotoxicity and to identify a non-cytotoxic dose, an IL8 ELISA to measure changes in IL8 protein secretion, and quantitative RT-PCR (qRTPCR) to measure other inflammation markers (cyclooxygenase 2 (*COX2*), cytosolic phospholipase A2 (*cPLA2*), and *TNF)*. No cytotoxicity was observed with the MTS assay, however, a slight decrease was seen using the LDH assay, starting at 50 mg/ml (ppm) in response to the pine WSP. The IL8 ELISA showed a pro-inflammatory response when treated with 25 mg/ml WSP (non-cytotoxic) quantified by an increase in IL-8 secretion. qRTPCR assays using 25 mg/ml WSP demonstrated that both *cPLA2* and *COX2* were significantly increased above controls following WSP exposure. cPLA2 is upstream of COX2 in the same bioactive lipid pathway. Additionally, we observed increased TNF in WSP exposed cells compared to control. From these results we suggest that A549 cells exposed to WSP are slightly cytotoxic above 50 mg/ml (by LDH), and elicit a pro-inflammatory response through both bioactive lipid and cytokine pathways at non-cytotoxic doses.
https://symposium.foragerone.com/2023-racas/presentations/56664

Elements: Preservation through Photography
Jonathan Enssle*, Arts & Media*
Mentor: Carol Golemboski

Abstract:
A cold wind rattles the dead branches of an ancient fir tree, blowing a sprinkle of glittering snow through the air. Somewhere hidden among the needles, a black squirrel stirs restlessly, then goes silent. Far above and beyond, the soaring peaks of granite hold back the winter, their peaks worn from the constant wind. Wild scenes like these are becoming rarer and smaller. Climate change, development, and tourism all contribute to the decline of wilderness in Colorado. *Elements* is a project dedicated to preserving these places in all their glory. Life in the Rocky Mountains is threatened by the very people who love it as irresponsible littering and high population all contribute to its decline.

Elements is a preservation of the now. There are wild areas that are not impacted by humans and *Elements* is dedicated to displaying them through fine art analog photography. By using a 4x5 camera, details are shown which no digital camera can replicate. Analog photography promotes the high standard that fine art photography has acquired over the centuries and allows the work to be about the art, not the artist. By photographing and developing in analog and printing with modern digital inkjets, the work is unlimited in its capacity.

Elements, however, is not an artistic statement, it is a replication of beauty and an expression of a divine order. Such work is not limited by political ideologies and personal opinions. It is a work that preserves the beauty and breathless wonder found in the backcountry Rocky Mountains.
https://symposium.foragerone.com/2023-racas/presentations/56704

Energy Efficient Cooling of Buildings in the Mountains
Ella Seevers, Cole Gropp*, Tech, Engineering, & Math*
Mentor: Eric Halingstad

Abstract:
Houses use lots of energy to stay cool, so how can we utilize biomimicry to design a method alternative to air conditioning for cooling houses and buildings that uses energy more efficiently and is more cost-effective in the long-term? In our experiment, we hypothesized that the design strategies used in biologically-based 3-D printed models would allow for their internal temperature to increase at a slower rate as compared to the external temperature of their controlled environment when tested with a heat lamp in an insulated box over several trials. The initial results showed that the experimental models did not gain less interior heat than the control; in response to this, we designed iterations based on what we learned from our first set of data collection, and took into account both which biological strategy would be best to focus on as well as how to avoid an excess of data. After measuring the surface temperature of several new models built with varying types of ribs modeled after cacti, we are able to conclude that the use of this biological strategy in engineering and design has the ability to cool the temperature of a surface given the proper ratios between shade produced and surface area, with our models of larger and more narrow ribs showing the most effective implementation of this concept. Future research might entail incorporating other features of cacti, different materials, or a larger scale, as well as possible applications to other areas of the world, such as warmer climates.
https://symposium.foragerone.com/2023-racas/presentations/56839

Estimating Genetic Disease Risk in Summary Data with Summix
Nikole Scribner Trout*, Biomedical Sciences*
Mentor: Audrey Hendricks

Abstract:
Recently, genetic summary datasets, such as genome wide association studies (GWAS), have become broadly available online. Recruiting controls for sufficiently powerful case-control studies to identify novel genetic variants is complex and expensive; therefore, making use of anonymized summary datasets in genetic research as common controls has a high degree of utility. However, important characteristics of individuals are obscured when summarized, resulting in issues such as the inclusion of unidentified disease cases that can limit the usefulness of

summary data. Here we investigate whether Summix, a method for detecting and adjusting for ancestry in genetic summary data, may also be used to estimate genetic disease risk in summary data. We use prostate cancer as a test case due to its high heritability. In summary data from the Colorado Center for Personalized Medicine (CCPM), Summix accurately estimates near 100% prostate cancer risk among prostate cancer case-only summary data. In data containing both cases and non-cases, Summix estimates of genetic prostate cancer risk converge to proportion of diagnoses as age increases and are within 1% of the proportion of prostate cancer diagnoses among the oldest age group. This is in line with expected behavior as genetic risk is realized over the lifespan of individuals. Further investigation will be performed on diseases of moderate heritability, using Type I Diabetes as a test case. The application of Summix to estimate the proportion of genetic disease risk in summary data opens the door for its use to detect and adjust for many genetically mediated diseases, which will greatly improve the utility of summary data as common controls in genetic studies.
https://symposium.foragerone.com/2023-racas/presentations/56660

ETHANOL AND SINUSOIDAL ENDOTHELIAL CELL PERMEABILITY IN THE LIVER: EXPLORING THE ROLE OF ANAPHYLATOXIN C3A

Sayra Salgado, *Biomedical Sciences*
Mentor: Rebecca McCullough

Abstract:
Persistent innate immune system activation plays a significant role in the progression of chronic liver diseases, including Alcohol-associated Liver Disease (ALD). Among the many cell types negatively affected by chronic alcohol exposure, liver sinusoidal endothelial cells (LSEC), which line the blood vascular system of the liver, become damaged and lose their ability to regulate macromolecule exchange between the tissue and blood but the mechanisms are not well understood. Complement, a component of innate immunity, is activated in ALD which is associated with tissue damage, but it is not yet known if complement can directly lead to LSEC dysfunction in ALD. Therefore, it is my working hypothesis that activation products of complement, including the potent anaphylatoxin C3a, can lead to endothelial cell dysfunction via decreased tight junction assembly and associated permeability in the liver vasculature.
https://symposium.foragerone.com/2023-racas/presentations/56625

Evaluating the Performance of Natural and Commercial Moisturizers for Dry Skin: A Study Using Agar Agar Skin Model

Vignesh Velmurugan, *Biomedical Sciences*
Mentor: Kalpana Velmurugan

Abstract:
Background: The importance of dry skin and moisturization is evident in its impact on skin health and quality of life, particularly in dry and low humid environments like Colorado. Moisturization is essential for maintaining skin elasticity, viscoelasticity, and differentiation, and its deficiency can cause various skin disorders. Oils and lotions are commonly used to prevent water loss and break the dry skin cycle. This project aims to compare the effectiveness of homemade and commercial moisturizers on a human skin model using Agar-Agar to determine the best moisturizer for keeping dry skin moist.
Materials and methods: For this science project, we created a home-made lotion with a combination of carrier oils (Neem, Castor, Coconut, Gingelly, and a blend of all four oils), humectants, occlusives, and emollients to moisturize the skin. We compared the effectiveness of our home-made moisturizer with various commercial moisturizers, including Lubriderm, Aveeno, Vaseline, and petroleum jelly, for treating dry skin. We measured the loss of water over time by weighing all the petri dishes, including the control group without moisturizers, and observed the change in height of the agar in the dish.
Results and discussion: The study found that the homemade lotion made from a blend of neem, castor, coconut, and gingelly oils was more effective than the other commercial moisturizers tested in maintaining skin moisture. The

results were supported by height and weight measurements of the petri dishes, as well as digital moisture monitoring, which showed that the combination of oils was able to retain skin hydration for a longer duration.
Further research is needed to confirm these findings and to determine the best combination of ingredients for different skin types.
https://symposium.foragerone.com/2023-racas/presentations/56541

Examining the Relationship Between Parental Executive Functioning Difficulties and Child Behavioral Concerns.
Madison Widick, *Social Sciences & Humanities*
Mentor: Jacob Holzman

Abstract:
Previous research has mainly focused on the relationships between parenting practices and child mental health concerns, particularly externalizing concerns. Further, studies show that child executive functioning difficulties are influenced by a multitude of factors including harsh parenting practices which worsen the risk for child externalizing concerns. When parental executive functioning (EF) has been examined in studies, the focus has been on maternal EF and its effect on parenting behaviors. To the best of our knowledge, there has been no examination of the direct links between parental EF and child externalizing behavior concerns. The goal of this study is to rectify this lack of information. Using a clinically referred sample of 34 children ranging in age from 3-7 years, a cross-sectional study was conducted before the parents entered a behavioral parent training program. The parental EF was measured using the Behavior Rating Inventory of Executive Function (BRIEF) Adult version, BRIEF-informant version, and an objective task measuring working memory. Child behavioral concerns were assessed using the caregiver-provided ratings of the Eyberg Child Behavioral Inventory.

Across correlational analyses parental EF difficulties were not significantly related to the frequency of child behavior concerns (r's = -.15-.21, p's = .24-.51) nor their problematic impact (r's = -.29-.10, p's = .18-.95). Post-hoc analyses only reveal a significant link between frequency and problematic impact of behavioral concerns (r = .67, p

These surprising results may be indicative of one of the major limitations of this study which is the small sample size. Several weak, but nonsignificant relationships between parental EF difficulties and child behavior concerns were observed. Given the discrepant findings from across methods measuring EF, future research should examine this question in a larger sample. Further implications will be discussed.
https://symposium.foragerone.com/2023-racas/presentations/56546

Experimental Analog Photography & LGBTQIA+ Gen-Z / Youth
Tyler Russell, *Arts & Media*
Mentor: Carol Golemboski

Abstract:
Generation Z is a unique group of individuals that is growing up in an unnatural time in the course of human history. As a member of Generation Z, I am constantly surrounded by social media and internet addiction, political distress, gun violence, and many other stressful societal factors. An oasis that I have found that has helped me express myself creatively and keep me sane is 35mm analog photography. In this project, I experimented with different 35mm analog photography stocks and alternative processes that I had not tried before. As for my subject matter, I prioritized shooting portraits of individuals who are in Generation Z and identify as LGBTQIA+. Some of the film stocks that I experimented with included Flic-Film 50D, Cinestill 400D, Kodak E100, Kono! Katz, and many more. Prior to developing the film in standard C-41 chemicals, I experimented further by creating "film soup" with many of the rolls. This involved soaking the films in a wide range of solutions ranging from white vinegar, tea, laundry detergent, lemon juice, salt, dish soap, Pepto Bismol, soda, and other household materials that could spark a reaction or a cool effect in the film. Then, I developed the films in exhausted C-41 chemicals in the CU Denver Photography Lab. Finally, the films were dried, cut, scanned into the computer (ironic I know), and placed in archival sleeves for future protection.

https://symposium.foragerone.com/2023-racas/presentations/56907

Foveal Capture: An Investigation of Distractors at Fixation
Dylan Kammerzell*, Social Sciences & Humanities*
Mentor: Carly Leonard

Abstract:
Many studies of vision and visual attention have investigated the influence of distractors on behavior during search tasks. Most of these studies examine search behavior where the target and the distractor appear in peripheral space while ignoring how central vision may impact the behavior. In the current study, we examine this concept by having participants perform a simple search task on which half of the trials have a distractor appear at the center of vision simultaneously with the search display. Eye movements are recorded during the task and used to test differences in a participant's ability to disengage from the center of the display when a central distractor does and doesn't appear. We also tested how color features of the central distractor can affect disengagement time by including 3 conditions within the distractor present condition: target match, where the central distractor color matches the target, peripheral match, where the central distractor matches a non-target color, and no match, where the central distractor matches nothing on the screen. The results showed that participants take longer to disengage from the center when a central distractor is present, and longer to disengage when the central distractor matches the target color compared to other distractor present conditions. These findings show that the Contingent Involuntary Orienting hypothesis applies to distractors at the fovea, while also providing other useful information for future research on attentional capture.
https://symposium.foragerone.com/2023-racas/presentations/56681

Geometric Mechanics of Hypar-derived Metamaterials
Trevor Walker*, Tech, Engineering, & Math*
Mentor: Shengzhe Wang

Abstract:
As we reach the middle years of the twenty-first century there has already been significant advancements in computer aided data analysis and optimization modelling. While new construction materials may not appear in the near future, particular construction methods that optimize the cost-benefits of materials combined with structural optimization to reduce the amount of material needed to achieve a desired result is completely capable in the current scope of engineering abilities. Materials created using efficient topology are called "metamaterials" and possess superior properties (strength, stiffness, etc.) relative to natural materials.

One way to create stronger, lighter, and stiffer materials is to use the unique shape of hypar surfaces, which resemble Pringle chips or saddles. By studying their compressive strength, we can determine their material properties and optimize their height, width, base shape, and array style to achieve the best mass to strength ratio. Hypar-derived metamaterials can offer greater strength and stiffness compared to traditional lightweight composites like honeycomb sandwich panels because of the inherent strength provided by this geometric pattern. This approach to construction may lead to new and improved materials that can be used in a variety of applications.

The objectives and tasks of this project are to gain a deeper understanding of the mechanics of failure in lightweight hypar structures, and to develop and optimize hypar-derived metamaterials with superior mechanical properties compared to conventional materials such as honeycomb sandwich panels.
https://symposium.foragerone.com/2023-racas/presentations/56725

Hilma af Klint, *The Swan* Series: Through the Lens of Metaphysics
Ashley Boucher*, Arts & Media*

Mentor: Maria Buszek

Abstract:
The spiritualist and artist Hilma af Klint entered the art historical canon of modern art more than forty years after her death, following an astonishing retrospective at New York's Solomon R. Guggenheim Museum in 2018, breaking museum attendance records. This presentation will focus on the life and work of af Klint, specifically the visual progression of the artist's *The Swan* series, comprised of 24 figurative and abstract oil paintings created from 1914-1915. This series will be analyzed through the lens of metaphysics as it acts as a gateway between the scientific findings of the late 19th and early 20th centuries and the world of the supernatural. This work will be compared to the work of af Klint's better-known contemporaries to elevate the artist's importance to the canon of art history.

When first exhibited in Los Angeles in the late 1980s alongside the work of the modernist pioneers Wassily Kandinsky, Piet Mondrian, and Kazimir Malevich, af Klint's work was met with resistance as the genius of this woman artist seemed to appear out of thin air, like magic. Indeed, during her lifetime af Klint would have argued that the manifestation of her work was in fact the work of higher powers—ethereal beings that she was able to channel and commune with through the practice of séances. It was her dedication to the spiritual in conjunction with being a woman in the late 19th and early 20th centuries that prevented af Klint from exhibiting her work to the public. Following her retrospective at the Guggenheim, scholarship began to emerge about the art and life of af Klint, which this presentation will draw upon.
https://symposium.foragerone.com/2023-racas/presentations/56667

How do you do Poly? A Narrative Inquiry of a Polycule
Lindsay Hayes*, Social Sciences & Humanities*
Mentor: Robert Allan

Abstract:
This study seeks to explore the lived experience of polyamorous individuals in a unit (polycule) as a group and as individuals. The literature review will investigate the extant research on polyamory and consensual non-monogamy while also highlighting the lack of information when compared with monogamous relationships. As non-monogamy becomes more common, research and scholarship must keep up with trends to help educators, therapists, social workers, and others understand the complexities of these relationships. This work seeks to provide an in-depth look at the complexities, nuances, and issues faced by a polyamorous group and its' individuals. A narrative inquiry comprised of one group activity and individual interviews is proposed to better understand the group's experience in conjunction with individual lived experience.
https://symposium.foragerone.com/2023-racas/presentations/56695

Identification of dorsal raphe nucleus afferents potentially involved in exercise-induced stress
Remla Abdul*, Biomedical Sciences*
Mentor: Benjamin Greenwood

Abstract:
Stress-related psychiatric disorders are the most common metal health disorders in the United States. Physical activity induces stress resilience resulting in reduced risk of future stress-related disorders. In rodents, six weeks of voluntary wheel running (VWR) enables protection from the anxiety- and depression-like effects of stress in both sexes. VWR prevents the behavioral effects of stress by constraining the activation of serotonin neurons in the dorsal raphe nucleus (DRN). However, the mechanism by which this occurs is unknown. One way in which VWR could constrain the DRN is by altering the activity of DRN inputs that provide modulatory control over DRN activity during stress. To determine if this is indeed the case, DRN-projecting neurons must be identified in brain regions projecting to the DRN. The goal of this study is to identify which retrograde tracer is most effective in showing the greatest number of DRN-projecting neurons within regions projecting to the DRN. This will allow us to isolate the neurons that project to the DRN when studying which region(s) might be responsible for constraining the DRN. The retrograde

tracers we will use include Fluorogold, red fluorescent retro beads, and retrograde adeno-associated virus expressing green fluorescent protein (AAV retro-GFP). So far, we found that the red fluorescent retro beads injected into the DRN successfully identified DRN-projecting neurons in the prefrontal cortex, nucleus accumbens, bed nucleus of the stria terminalis, habenula, and the locus coeruleus. These data suggest that the red fluorescent retro bead tracer is an effective retrograde tracer in identifying DRN projecting neurons in a large proportion of DRN afferent regions. Further analysis of the Fluorogold and AAV retro-GFP tracers will need to be performed to compare their effectiveness relative to the red fluorescent retro bead tracer.
https://symposium.foragerone.com/2023-racas/presentations/56653

Identifying Bacteria Capable of Degrading the Carcinogen 1,4-Dioxane
Mindy Kennedy*, Natural & Physical Sciences*
Mentor: Timberly Roane

Abstract:
1,4-dioxane—a chemical used in several manufacturing processes, including pharmaceuticals, pesticides, and cosmetics—was classified by the Environmental Protection Agency (EPA) as a likely carcinogen, with effects of exposure ranging from nausea to tumors, depending on the severity of exposure. Concentrations of dioxane leached from municipal and industrial wastes have been detected in groundwater underneath the once-active Lowry Landfill site in Aurora, CO.
While waste disposal at the Lowry Landfill ceased in 1984, chemical contaminants continue to impact the underlying groundwater. It has been discovered that existing communities of bacteria in the groundwater can break down the dioxane. Although this process is effective by the EPA's standards, there is little knowledge of the identity of the bacteria involved and how they are carrying out the degradation. In addition, the predicted bacterial energy source—another carcinogen called tetrahydrofuran (THF)—is depleting, which may negatively impact further dioxane degradation. Identifying and characterizing these bacteria is essential to determining how to best support their degradation of dioxane to remediate the groundwater.
Genetic sequencing and identification determined that hundreds of unique species are present in the groundwater. An estimated 25 bacterial isolates have been cultured and are predicted to be dioxane-degraders. The identities of a few of these isolates include *Stenotrophomonas* spp. and *Pseudomonas* spp. with additional identifications underway. Continued experimentation will elucidate how these species are degrading the dioxane and if dioxane degradation can be enhanced.
https://symposium.foragerone.com/2023-racas/presentations/56613

Identifying Fake Accounts (Sybil's) On LinkedIn
Mirakle Wright*, Tech, Engineering, & Math*
Mentor: Haadi Jafarian

Abstract:
Social media bots are an increasingly popular tool for cyber criminals to influence online interactions on many online social networks. There are many types of social media bots, but in this research, our aim is to focus on Sybil bots, which are fake accounts. Fake accounts are created on various online social networks to make connections and draw out information from unsuspecting users for fraud, spam, and other malicious activities. Related literature mainly focuses on using digital tools like machine learning to identify fake accounts, with only a few studies focusing on assessing humans' ability to identify fake accounts. To address this gap, the first objective of this qualitative study is to analyze the ability of an average IT student, who is expected to have a good understanding of social media and fake accounts, to determine whether an account is fake or real on LinkedIn. Then, hypothesizing that education could play a constructive and noteworthy role in improving users' ability to detect fake accounts, the second objective of this investigation is to demonstrate how education can enhance the ability of users to accomplish this. This study focuses on LinkedIn, given the prevalence of fake accounts on the platform. We conducted two rounds of surveys with a group of 47 participants recruited from the computer science program of our institution to conduct our qualitative analysis. Prior to the second survey, participants watched a short video providing hints on detecting fake

accounts. Primarily, our results show that watching a short but informative educational video improved participants' accuracy in detecting fake accounts from 54% to 61%. This result is significant because it shows that education can improve users' ability to identify fake accounts, thus decreasing their risk of being a victim of malicious online activity by fake accounts.
https://symposium.foragerone.com/2023-racas/presentations/56677

Identifying Novel Epigenetic Modifers to Treat T-Cell Lymphomas In Vitro.
Xander Bradeen*, Biomedical Sciences*
Mentor: Eduardo Davila

Abstract:
T Cell Lymphomas (TCLs) are a rare subtype of Lymphoma, occurring in ~1% of all cancers and response rates to current therapies reach only ~23%. The lack of unique targetable T cell antigens as well as their tendency to overcome chemotherapies results in a high incidence of relapse in most patients leading to remission rates of approximately two years. The standard of care treatment for relapsed/ refractory disease is salvage chemotherapy or enrollment in clinical trials. Yet, most patients still develop chemo-resistant disease while still experiencing adverse effects from aggressive treatment. Additionally, TCL presents as an incredibly heterogeneous disease, making overall response rates to standard treatments low. The chemotherapeutic potential of epigenetic modifiers is just beginning to be explored. HDAC inhibitors, DNA demethylating agents, and histone methyltransferase inhibitors reshape the transcriptome, potentially overcoming TCL resistance to induced cell death or to other chemotherapeutic agents. We hypothesized that treating T cell malignancies with epigenetic modifiers will alter key genetic signatures and selectively induce cell death in the malignant cells versus healthy peripheral blood mononuclear cells (PBMCs). We treated five T cell lymphoma cell lines, representative of different T cell malignant diseases with compounds from an FDA-approved 700+ epigenetic modifying drug library at four different concentrations, and identified a list of compounds that induced apoptosis across all cell lines. Next, we explored these compounds' efficacy in additional TCL cell lines as well as healthy PBMC donors to assess malignancy specificity. We then identified a topoisomerase I inhibitor, as the compound with the greatest and most targeted effect. Additionally, we found that at lower concentrations, it acted synergistically with a pan-HDAC inhibitor. While we are still exploring the mechanism underlying this synergy, our studies have identified a promising novel approach at treating TCL with low-dose efficacy that demonstrates tumor-specific cytotoxicity.
https://symposium.foragerone.com/2023-racas/presentations/56620

Impacts and Implications of the Summer internship for INdigenous peoples in Genomics Workshop
F. Leah Nez*, Social Sciences & Humanities*
Mentor: Katrina Claw

Abstract:
The Summer internship for INdigenous peoples in Genomics (SING) workshop is a week-long workshop and mentoring program led primarily by Indigenous faculty. The SING workshop covers technical and laboratory skills in genomics as well as ethical, legal, social implications (ELSI) of genomic research and the benefits and risks of genomics for Indigenous peoples. The conduct of beneficial research with Indigenous peoples has been challenging. There is a long history of research abuse towards Indigenous communities, including but not limited to research that is unfavorable for the communities, lacking adequate informed consent, no communication or return of results to the people, and many other issues. Now in its 11th year, the program has over 140 alumni, many of whom work in fields engaging genomic research and, more broadly, in health sciences, community engagement, and ethics. While transition to faculty among prior participants and ongoing collaborations among alumni anecdotally indicate the importance of SING in career growth, a formal analysis of the impact on program participants and faculty is lacking. In order to gain insight into the impacts and implications of SING on the careers and networks that have formed from this training program, a series of focus groups and individual interviews with SING alumni and faculty were conducted between February and March 2023 as part of the *SING USA Perspectives and Social Network Analysis Study*. Recruitment was conducted through the SING listserv, personalized emails and social media. An independent

facilitator conducted the focus groups and interviews. Our preliminary findings reveal research relationships, peer networks, and research collaborations from participants in SING have been transformative in their education and development of their research interests and career paths. Compiling these perspectives will inform ongoing and novel programs oriented for Indigenous scientists and community members in genomic research and ELSI considerations related to genomics.
https://symposium.foragerone.com/2023-racas/presentations/56571

Impacts of the Immigration Process and Transition on Mental Health
Alice Lin, Saron Bitew*, Social Sciences & Humanities*
Mentor: Lucy Dwight

Abstract:
For years the United States has been referred to as the nation of immigrants. Between 1783 and 2019, 86 million people have legally immigrated to the United States along with an additional 11.48 million who are undocumented. Immigrating to the United States can be a difficult process, although for many, the benefits outweigh the strenuous journey. Across the globe, people have immigrated to the United States for economic, employment, and educational opportunities. Others immigrate to the United States because of persecution, terrorism, conflict, or possibly disastrous environmental factors. Their main reason for exiting their country and moving to the U.S. is to acquire better opportunities. Immigrating to the U.S. can be a hard and lengthy journey which may not result in citizenship, but deportation. Further, anxiety and depression are some of the most common mental health disorders in the world and are often precipitated by stressful life events. Migrants have many stressors as they acclimate to their new countries including the reasons for leaving their country and the immigration process. This leads to our research question: does the immigration process pose mental health risks for the immigrant community? We hope to explore this topic by reviewing a cross-sectional study from the National Health Survey (NIHS), which randomly surveys adults and children across the United States on a yearly basis. The core questions of the NHIS covers anxiety, depression, health insurance, access to health care, and nativity. We plan to compare foreign born and native-born populations pertaining to their generational changes.
https://symposium.foragerone.com/2023-racas/presentations/56604

Impacts of thermoneutral housing on mitochondria in the brain
Desiree Reeves*, Biomedical Sciences*
Mentor: Amy Keller

Abstract:
Cardiovascular disease, characterized by vascular dysfunction, is associated with a higher risk of dementia in later life. Women have a differential risk of CVD and are two times more likely to develop dementia than males. It is important to characterize mechanisms of vascular neuropathology, , and we have previously reported diminished vascular function in rats housed at their thermoneutral temperature (30°C, TN). As mitochondrial dysfunction is concurrent with vascular impairment, and CaMKII modulates mitochondrial function via calcium uptake, we hypothesized that rats housed at TN, have differences in overall brain mitochondrial function and CaMKII activity than rats at room temperature (24°C, RT). We housed Wistar rats at RT or TN conditions for 16 weeks and measured whole brain citrate synthase and mitochondrial complex I activity, in addition to protein expression of all complexes and CaMKIIα and β. We measured a significant interaction effect of temperature and sex on citrate synthase activity, resulting in male brain showing an increase at TN (pexpression, through florescent microscopy.https://symposium.foragerone.com/2023-racas/presentations/56700

Implications of U.S. Immigration Restrictions on Medicare
Chloe Tan*, Social Sciences & Humanities*
Mentor: Lucy Dwight

Abstract:
Given the bleak projections regarding the vitality of Medicare within the next decade, significant, long term, and swift changes are required to replenish and stabilize this system in which millions rely on. The aim of this study is to analyze available data and research representative of foreign-born and U.S. born financial contributions to Medicare. This issue was examined through the lenses of relevant legislation, U.S. population characterized by age, and trust fund expenditures and contributions. Methodologies were derived from the model by Zallman et al. (2013). Data retrieval tools such as the Current Population Survey and Medical Expenditures Panel Survey were used to calculate trust fund contributions and expenditure data, respectively. These numbers were further described based on nativity and foreign-born statuses. The data was analyzed using descriptive analysis comparing varying contributions among native-born and foreign-born to their expenditures. The proportion of contributions and expenditures among foreign-born to U.S. born citizens showed greater amount in withdrawals from a larger population of U.S. senior citizens. Additionally, an increasing gap of HI revenue versus expenditures further supports the need for the stability of a larger working population that immigration can provide.
https://symposium.foragerone.com/2023-racas/presentations/56640

Indigenous Identity: Weaving an identity
Junior Reina Toc*, Social Sciences & Humanities*
Mentor: Sheila Shannon

Abstract:
Drawing on the lived experiences of 11 self-identifying Indigenous Peoples, the purpose of this study was to investigate how do Indigenous adults describe the impact of K-12 schools on their identities along with learning how sharing stories with study participants inform my own reflections of identity and schooling, I examined the struggles they faced while in K-12 educational systems, paying close attention to their resiliency, hope, and ceremony use. Indigenous theoretical frameworks are best suited to describe the participants' experiences through this research where I will describe the significance of the study, research design, research questions and data collection and analysis process.
https://symposium.foragerone.com/2023-racas/presentations/56643

Inference of bacterial pathogen load in US rivers from landscape-scale shotgun metagenomic sequencing
Alyssa Cruz*, Natural & Physical Sciences*
Mentor: Chris Miller

Abstract:
Surface waters have been shown to contain possible human pathogens, but pathogen sources and breadth of distribution remain understudied with modern methods. Utilizing high-throughput DNA sequencing methods like metagenomics, large-scale microorganism identification can be completed in an unbiased manner, including for potential pathogens. In addition, metagenomics provides the functional and metabolic potential of these communities, possibly offering insight into the way potential pathogens persist in surface waters. Using hundreds of surface water samples from the Genome Resolved Open Watersheds (GROW) project, we are characterizing the pathogenic potential of samples taken from freshwater ecosystems impacted by a range of human activities. Samples are highly varied and come from diverse locations, ranging from relatively pristine rivers, to polluted by anthropogenic input. As a proxy for pathogenic potential, these samples are being used for broadly characterizing virulence factor diversity and distribution. Using a set of 2093 high-quality Metagenome Assembled Genomes, candidate virulence-associated proteins were identified using homology searches against the Virulence Factor Database (VFDB) for an array of medically significant pathogenic bacteria. The VFDB encompasses 14 categories of major bacterial virulence factors stemming from 32 genera. We identified 27,177 unique candidate virulence factor proteins using specific homology search criterion (e-value
https://symposium.foragerone.com/2023-racas/presentations/56661

Influence of the Biomechanical Environment on Islet Function and Maturity
Devon Horton, Andrea Laurin, *Biomedical Sciences*
Mentor: Kelly Vazquez

Abstract:
It is well-established that cells respond to mechanical cues via cytoskeletal remodeling. However, it is not known whether the mechanical environment influences β-cell maturity and function. To examine how mechanical cues influence the β-cell, we used biocompatible substrates with tunable mechanical properties synthesized with elastic moduli ranging from ~3kPa–33 kPa. The surface was coated with extracellular matrix and MIN6 β-like cells were seeded. To independently examine a link between β-cell function and maturity, we examined islets from mice in which β-cells express CaMPARI, a photoconvertible fluorescent protein that in the presence of high Ca2+ activity changes from green to red. For all conditions in MIN6 cells and CAMPARI-expressing islets, we imaged Ca2+ dynamics via Fluo4 at low (2mM) and high glucose (11, 20mM). qPCR was conducted on MIN6 cells (6, 22 kPa) and flow-sorted CaMPARI-expressing β-cells (green, red) to examine expression of genes linked to β-cell function and maturity. With increased substrate stiffness, MIN6 cell Ca2+ oscillations were more robust, including a significant increase in duty cycle (*p*(p Thus, the dynamics and coordination of Ca2+ activity is mechanoresponsive and may result from altered β-cell maturity. In CaMPARI islets, Ca2+ oscillations were more robust and coordinated for photo-converted red cells which marks cells with higher Ca2+, compared to green cells. In these red cells that show higher Ca2+, qPCR showed significantly increased expression of cFos, but decreased expression of Pdx1 and Ins2, again showing more excitable cells showed altered maturity. In conclusion, our results suggest there may be an inverse relationship between β-cell maturity and function. Further, that the maturity and function of β-cells is responsive to the mechanical environment. https://symposium.foragerone.com/2023-racas/presentations/56560

Inhibiting the Fructokinase metabolic pathway reduces alcohol drinking in Wistar rats
Erin Jandebeur, Tim White, *Biomedical Sciences*
Mentor: Sondra Bland

Abstract:
In the United States, the most common form of excessive alcohol consumption is binge drinking, defined as four drinks for women and 5 drinks for men. Binge drinking can be detrimental to an individual's health in the short term and long term. Reducing binge drinking is important for an individual's mental and physical health. Using a rat model of binge-like drinking, we investigated whether binge drinking behavior can be reduced by targeting the fructokinase metabolic pathway, because previous work in our laboratory suggested that this may be an effective therapeutic target. Female Wistar rats were given access to ethanol 3 times a week for 5 weeks before receiving a vehicle using a 2 bottle choice with 15% alcohol in one bottle and water in the other. For an additional 4 weeks rats received a vehicle, either methyl cellulose or the Pfizer drug PF-06835919, which reduces fructokinase activity, before having access to ethanol. PF-06835919 reduced fructokinase activity which lowered the conversion of fructose and ATP to fructose-1-phosphate and ADP. Alcohol consumption decreased consistently and markedly after selected rats started the drug and continued decreasing through the end of the study. We then used immunohistochemistry to assess the brains for FosB/DeltaFosB, which are the protein products of immediate early genes implicated in reward. Regions within the dorsal striatum and nucleus accumbens were assessed. The dorsal lateral striatum showed an effect toward the drug. Cell counts for FosB/Delta FosB, a protein coding gene, were higher in vehicle-treated animals showing suggesting us that the dorsal lateral striatum, which is important for habit learning, may play a role in these differences in alcohol drinking. We will also present FosB/Delta FosB results from subregions of the medial prefrontal cortex.
https://symposium.foragerone.com/2023-racas/presentations/56813

Initial Development of a ^{3}He Neutron Flux Detector
Alya Sharbaugh, *Natural & Physical Sciences*

Mentor: Anthony Villano

Abstract:
One of the greatest challenges facing the dark matter community is background reduction. Dark matter experiments, such as the Super Cryogenic Dark Matter Search (SuperCDMS), take significant steps to reduce the presence of noise, but several sources persist. The most significant background is induced by low energy neutrons, which can create signals similar to those theorized by dark matter models. In order to confirm dark matter detection, this background must be mitigated. This project proposes developing a neutron flux detector using liquid helium-3 to reliably measure the neutron flux near the SuperCDMS cryostat. This poster will present theoretical signal models, plans for constructing a prototype, and expected efficiency boosts compared to current leading detectors.
https://symposium.foragerone.com/2023-racas/presentations/56626

Investigating the Stability of the M13 Phage Carrier State in Escherichia coli
Alex Harvey*, Biomedical Sciences*
Mentor: John Fisk

Abstract:
• The M13 bacteriophage infects E. coli with a unique life cycle which allows for virion production/expulsion without cell lysis, while passing the infection on to the next generation of E. coli.
• M13's unique life cycle and small genome provide it with great potential to be used for a variety of applications in the study of gene expression and biotechnology.
• However previous researchers have observed the M13 infection becomes unstable after 10 15 generations of cell growth, at which point the proportion of infected cells declines exponentially, limiting the potential utility of this phage in both business and academia.
• To determine the validity of these infection instability observations and better understand the associated mechanisms, we are designing an experiment to reevaluate these past researchers' observations in the Fisk Lab.
• M13 phage provide their host with Kanamycin resistance, so generations of infected cells and the proportion of infected cells in a culture can be tracked by plating cultures on petri plates both with and without Kanamycin to create growth curves for infected and non infected cells in a culture.
• We first designed a procedure to track the growth of uninfected E. coli with plates to establish a protocol which can be utilized to track the long term growth of many generations of M13 infected E. coli over several days.
• The first 7-8 generations of E. coli growth have been successfully tracked during the first day of plating, but efforts to track subsequent generations of the same culture over a second day of plating have thus far proven unsuccessful.
https://symposium.foragerone.com/2023-racas/presentations/56713

Invisible Enemies: How COVID-19 Related Hate Crimes against the AAPI Community Have Affected Police Perceptions
Jessica Valdez*, Social Sciences & Humanities*
Mentor: Melissa Tackett-Gibson

Abstract:
Over the last decade, police-community relations have been strained. To rebuild those relations, it is necessary to understand how citizens perceive the police, the causes of these perceptions, if these views are based on accurate data, and how we can begin to change these perceptions. A review of multiple studies regarding these topics indicates that perception of effectiveness of the police, as well as perceptions about crime and safety were strong predictors of how satisfied citizens were with the police, and how common they thought misconduct was in their neighborhoods. Additionally, mainstream media is one of the foremost sources of information about law enforcement. However, many studies of police perceptions were done before the year 2020 and primarily address Black, White, and Hispanic/Latino populations, failing to include Asian-American/Pacific Islander views. This is even more relevant to study considering the increase in hate crimes towards the Asian-American/Pacific Islander community because of COVID-19, and how that may have affected police perceptions. Moreover, the concept of

prosecuting a hate crime is also something relatively new to the criminal justice system. The first federal statutes were not passed until the 1980s, and corresponding state laws followed in the 1990s. Through surveys and interviews, this project aims to understand the current views the Asian-American/Pacific Islander community has regarding law enforcement. The influence of race, pre-Covid personal experiences with the police, and experiences with the police when reporting a hate crime will be examined. This presentation will examine results from a literature review of past surveys of Asian-American/Pacific Islander perceptions of the police, as well as discussing the design and distribution process of the current survey, and next steps for the project. At the end of the project, policy recommendations will be made for the criminal justice system, including the police, courts, and legislation.
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Ionization Observation: Using High Performance Computing to Time Electrons Escaping from Atoms
Leah Piotrowski, Hamza Mekuria, Andrew Ebert, Parinoz Abdulloeva*, Natural & Physical Sciences*
Mentor: Kathryn Hamilton

Abstract:
Ionization is a process in which an electron is removed from an atom or ion, typically following the absorption of a photon (a packet of light). While on a human timescale the process of ionization may appear to be instantaneous, on the timescale of the electron this can take a non-trivial amount of time. Measuring this time is important not only to increase our understanding of light-matter interactions at their most fundamental level, but also has applications further afield in biology and medicine, where we can apply this knowledge to processes such as photosynthesis, or how UV radiation causes the DNA damage which can ultimately lead to cancer.
Observing ionization in a laboratory setting is extremely difficult to do, as electrons are both incredibly small, and move incredibly quickly. Therefore, it is usually more convenient to understand light-matter interactions using theoretical or computational means. Light-matter interactions at the atomic scale are governed by the Time-Dependent Schrödinger Equation, or TDSE. Solving the TDSE analytically is only possible for in certain simple cases, and so for complex systems computational methods must be employed. Even then, obtaining solutions to the TDSE is a very computationally demanding task, as is the analysis and interpretation of the result.
In the CU Denver Atomic, Molecular, and Optical Physics Theory group we apply the techniques of high-performance computing (HPC) to obtain fast and accurate solutions to the TDSE. By using HPC we are able to capture more of the relevant physics involved in light-matter interactions, particularly relating to the process of ionization. We also produce our own Python scripts to aid in the analysis and visualization of our results, and to create new laser schemes to be used in our calculations. We hope that this multi-faceted approach will help to “shed a little light” on light-matter interactions.
https://symposium.foragerone.com/2023-racas/presentations/56593

Knockout of ccl2 within the intestinal epithelium leads to protection in the OA of obesity
Xaverine Celia Moneboulou Mbazoa*, Biomedical Sciences*
Mentor: David Villani

Abstract:
Osteoarthritis (OA) is the leading cause of work disabilities and the most degenerative joint disease. Obesity-induced OA has been linked to gut microbiome dysbiosis, which accelerates cartilage degeneration, leading to chondrocytes promoting the activity of macrophage recruiters such as the monocyte chemoattractant protein-1 (MCP1) Ccl2. The available OA treatments are palliative. To our knowledge, no one has treated gut microbiome dysbiosis by ablation of Ccl2 in the intestinal colon to protect the knee joint from OA. In this study, Ccl2 was knocked out in the intestine to slow down OA in the joint. Following the murine model, mice were placed on either a high-fat (HF) or low-fat (LF) diet and administered tamoxifen to knockout Ccl2 and a surgical destabilization of the medial meniscus; as well as a sham surgery to induce OA.
A series of Saf/O fast green staining and immunohistochemistry was performed, and the cartilage was quantified using the Zen software and GraphPad. Ccl2 ablation (Cre+/-) in HF mice resulted in a lower expression of MCP1 in the intestinal colon and slowed down OA progression. This was seen in the knee joint, which had more cartilage area

following Ccl2 ablation with p-values less than 0.05. In the femur, the Hf p-value when comparing the mice with and without Ccl2 ablation was p=0.04, and in the tibia p=0.03, which was significant. The reduction in the abundance of MCP1 once Ccl2 was knocked out implied less migration of
proinflammatory macrophages and cytokines, resulting in knee joint protection from OA in obesity-induced OA.
https://symposium.foragerone.com/2023-racas/presentations/56631

Light Curve Analysis of BL Lacertae
Katie Riley*, Natural & Physical Sciences*
Mentor: Alberto Sadun

Abstract:
BL Lacertae (BL Lac) is an active galactic nucleus (AGN) that is highly variable and energetic. AGNs are regions located at the center of distant galaxies that emit forms of luminosity across the electromagnetic spectrum. This light being emitted from jets of ionized matter off the AGN. For this research we measure the photometry of AGNs through the Asteroid Terrestrial-impact Last Alert System (ATLAS) to be able to collect data on an AGNs brightness over time or, as it will be referred to, a light curve. After observing a flare in the time frame from September to November we began a multiwavelength collaboration to further observe and analyze the source. This poster will entail some of the results of that collaboration.
https://symposium.foragerone.com/2023-racas/presentations/56623

Light Curve Microvariability of B023-G078
Brie Clarke, Shilene Davis*, Natural & Physical Sciences*
Mentor: Alberto Sadun

Abstract:
Intermediate mass black holes (IMBH) have been hypothesized to be a rarer type of black hole, as they have more mass than a stellar mass black hole but less mass than a super-massive black hole. IMBH are thought to be found in globular clusters, which contain older populations of stars. Looking at globular cluster B023-G078, located in M31,we investigated the potential presence of an IMBH in the optical range. To do this, we utilized the Asteroid Terrestrial-impact Last Alert System (ATLAS) telescope to gather data for the years 2016-2021. We gathered data for flux and magnitude and calculated the changes in magnitude and standard deviation. We looked for changes of ±0.1 in magnitude and a standard deviation of +5 or greater. Using these criteria, we searched for times where B023-G078 met those conditions, defining the times it satisfied them as “events.” These conditions helped us to look for microvariability in the globular cluster’s flux, which is an indicator of an IMBH within it. Given the changes we observed in the flux and the number of events seen, we found that there is compelling evidence for the existence of an IMBH within B023-G078.
https://symposium.foragerone.com/2023-racas/presentations/56594

Longitudinal Knowledge Inventory of College Chemistry Students
Desiree Starzyk*, Natural & Physical Sciences*
Mentor: Priscilla Burrow

Abstract:
College chemistry courses suffer from high DFW rates and are often seen as “gatekeeping” courses. Failing or dropping out of a course frequently causes a student to change majors or even withdraw from college completely. The aim of remediating a problem that has multiple root causes requires that we first set out to understand what students know. Concept inventories are a standard method to obtain a snapshot in time of student knowledge. And while these are helpful, they are not enough. A full understanding of the problem requires answering many questions. How long do students retain concepts? Do concepts become solidified as students’ progress through upper-level

courses or are they forgotten? Here we present a longitudinal concept inventory in college level chemistry. Students were given a quiz containing 18 questions designed to test their knowledge of three core concept areas to which they are exposed throughout a four-course sequence at the beginning of each semester. The concepts tested were intermolecular attractive forces (IMAFs), general acid-base topics, and stoichiometry. The four courses were General Chemistry One and Two Lab, and Organic Chemistry One Two Lab. At CU Denver, the lab courses are separate from the lecture component of the course. Our results show that students show significant gains each semester in IMAFs and acid-base topics but show no significant gain in stoichiometry knowledge. Results also show that the average entry test score of students who did not continue past General Chemistry One Lab were not significantly different from those students who completed all four courses in the sequence.
https://symposium.foragerone.com/2023-racas/presentations/56614

Love and Lust
Chynna Whittaker, *Arts & Media*
Mentor: Andrew Bateman

Abstract:
Love and Lust is an autobiographical film about dealing with mental illness. The story is about my own experience after a seemingly fulfilling relationship in my life ended abruptly. Helga represents me after the relationship, and Louis, who plays my ex-boyfriend, is someone Helga sees in real life at work and also figuratively at home. Her fantasies about what the relationship was, a lustful and short-lived experience, gets interrupted when her sister, Wendy, and her boyfriend, James, come over for dinner and stay the night. This frustrates her and she continues to disassociate and think about Louis until her final dream in the film. It is apparent that Helga is in denial about the relationship being over, which significantly impacts her decision to let go.
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Marijuana Use in Pregnancy: Understanding How Gestational Cannabidiol (CBD) Consumption Effects Compulsivity and Postnatal Tissues
Kamryn Korth, *Natural & Physical Sciences*
Mentor: Emily Bates

Abstract:
Cannabis consumption has seen a dramatic rise over the past few decades, especially since the drug's legalization in 20 states as of 2023. With the rise of cannabis use as a whole, use during pregnancy has also seen a stark increase. From 2002 to 2017, the amount of pregnant women who reported that they consumed marijuana during gestation doubled, from 3.4% to 7.0%. The effects of consuming tetrahydrocannabinol, or THC (the psychoactive component of marijuana), while pregnant are somewhat well studied. However, the effects of gestational consumption of the non-psychoactive component cannabidiol (CBD) are relatively unknown. CBD has increased in popularity among pregnant women as it is known to aid with symptoms associated with pregnancy, namely: nausea, insomnia, loss of appetite, and pain. Due to CBD's nonthreatening consumption methods (tinctures, oils, edibles), in addition to the fact that it is plant-derived, many pregnant women believe that consumption will not negatively affect their developing fetus. Cannabidiol binds and activates to different receptors in the brain that indicate potential negative fetal outcomes. The primary receptor examined here is the serotonin receptor, 5-HT1A, which plays a role in the development of the prefrontal cortex as well as different cognitive behaviors. Increased compulsivity in offspring who gestationally consumed marijuana has been studied and shown significance in the past. Using a mouse model we quantified how CBD alone affects compulsivity in fetal outcomes. Through analysis of marble-burying trials (known to measure compulsive behaviors), we found that CBD has gender-difference implications in increased offspring compulsivity.
https://symposium.foragerone.com/2023-racas/presentations/56621

Masculinity within Disability: When Gender Roles Collide with Disabled Bodies
Henry DeAngelis*, Social Sciences & Humanities*
Mentor: Swartz Omar

Abstract:
Although masculinity and disability have been increasingly popular topics of academic study over the last 30 years, their intersections are rarely examined, particularly as it pertains to young disabled men. Traditional scripts of masculinity and disability typically conflict, causing distress I term the dual crisis. Prominent gender and disability studies scholars have researched masculinity and disability individually, but almost no one has researched how young disabled men feel about gender. This gap creates a dual crisis of identity. There is also a lack of therapeutic tools to support young disabled men, which is especially troubling in the context of pervasive stereotypes about men that they are exposed to, such as men not needing emotional support. My project addresses these identity issues as I develop a therapeutic intervention model to mentor young disabled men. In order to build the foundations for my model, I will analyze contemporary issues at the intersection of disability and masculinity. First, I examine the place of disability in traditional masculine scripts and the role of masculinity in traditional disabled scripts. Next, I explore contemporary research and accounts of disabled masculinity. Finally, I outline and discuss my therapeutic intervention model for young disabled men. Combining the previous clinical research of Gerschick and Miller with academic gender and disability studies discussions, I argue that a non-confrontational, educational, and conversationalist therapeutic approach can aid young disabled men as they navigate their own disabled masculine identity. This therapeutic approach can be applied in daily conversations by parents, therapists, older siblings, and any other mentor figures with a foundational understanding of the model. Through closely examining the intersections of disability and masculinity, this project explores the rarely discussed issues raised by masculinity, disability, and disabled masculinity as I propose a therapeutic intervention model to mentor young disabled men struggling with their identities.
https://symposium.foragerone.com/2023-racas/presentations/56559

Masculinity, Aging, and Health: A Rhetorical Analysis of *Tulsa King* and the Rise of the "Geriaction" Subgenre
Kathryn Yazgulian*, Social Sciences & Humanities*
Mentor: Lisa Keranen

Abstract:
Cultural observers have noted that today's action stars bear an uncanny resemblance to those of the past—more specifically, today's action stars may indeed rehearse the *same* action star tropes of forty years ago, portraying roles strikingly similar to those seen in 1980s hits like Magnum PI, Rambo, and Indiana Jones. These depictions reveal the rise of what film and televisual scholars have called the "geriaction" subgenre, in which actors of a certain age reprise their earlier action roles with few limits on their health or corporeal capacities. Grounded in an emerging interdisciplinary subfield known as the rhetoric of health and medicine, this research explores the dynamics and consequences of the "geriaction" subgenre though rhetorical analysis of the popular Taylor Sheridan production *Tulsa King*. By engaging three frameworks simultaneously—reclamation, intersectionality, and differing masculinities—the construction of masculine bodies and sexuality within the context of dominant cultural narratives is explored. Ultimately, the project identifies how the "geriaction" subgenre, as revealed by the case of *Tulsa King*, works to shore up dominant narratives about masculinity in ways reify youth and ability, while equating male health with virility. For scholars in the rhetorics of health and medicine as well as in disability studies, these seemingly mundane portrayals nonetheless carry consequential cultural implications because they define whose bodies are seen as worthy and powerful, and whose are not.
https://symposium.foragerone.com/2023-racas/presentations/56632

Mating Traits Shape Responses to Global Change in Nearctic Dragonflies
Sarah Nalley*, Natural & Physical Sciences*
Mentor: Michael Moore

Abstract:

The intensifying forces of human-driven environmental change, including global warming and habitat modification, are heating the habitats of both humans and wildlife. As temperatures rise, animals require traits that facilitate both survival and reproduction. However, the role of mating characteristics in responding to global change is poorly understood. Dragonflies are well suited for examining this theme because they possess two key mating traits – 1) melanin wing ornaments, which attract mates but absorb solar radiation and cause overheating, and 2) a waxy pruinescence that intimidates rivals and prevents overheating and water loss. I explored how ornamentation and pruinosity affected species' abilities to persist in habitats altered by two agents of environmental warming: rising air temperatures and burning of forests. I prioritized sustainable methods by utilizing publicly available data, including methods from recent research on dragonfly persistence, satellite data from the Climatic Research Unit, and US Geological Survey geospatial records. Species' persistence, temperature change, and burned area were measured in 100x100 km grid cells across the US from 1980-2021. Mixed-effects models tested if 1) ornamented species were less likely to persist in habitats with greater climatic warming and wildfire destruction, and 2) pruinose species were more likely to persist under these conditions. My results show that climatic warming harmed ornamented species more than non-ornamented species. By contrast, pruinose species proved more robust than non-pruinose species independent of increased temperatures or burned habitat. Wildfire adversely affected all species independent of mating traits. These findings highlight the role of dragonflies' mating traits in response to global change. Understanding complex interactions between selective forces, macro- and microhabitats, and the changing planet is vital to conserving animal populations. Publicly available data is a resource for sustainable management, and sustainable research methods are valuable for reducing our impact on the Earth we aim to protect.
https://symposium.foragerone.com/2023-racas/presentations/56589

Meaning in the Algorithm Age: Visual Culture and Internet Pictures
Alex Moreci, *Arts & Media*
Mentor: Maria Buszek

Abstract:
Since the emergence of Web 2.0 in the early 2010's, internet artmakers have increasingly gathered on platforms such as Instagram, Twitter and TikTok to share their art and gain recognition. While this has often been hailed as a great 'democratization' of the once gatekept art world, this presentation intends to reveal the problematic nature of such a structure. Artmaking has been casualized and devalued by these platforms, who stand between creators and audiences and siphon what value they can from both. The artwork that has emerged from these spaces exists in the "gray area" of the art landscape. For a variety of reasons, they seem to reject typical study and categorization, existing not so much as 'art', but as 'visual culture'. Many of these works are never intended to sit in a gallery, and their value often exists in reference to a particular fandom or subculture. Regardless, they represent the most diverse, popular, and accessible form of artwork today. The often-pseudonymous creators who make these 'internet pictures' face new challenges of authenticity, authorship, and authority that threaten to further devalue and delegitimize their work. At the heart of everything are the algorithms, opaque black boxes which have become the architects of 21st century visual culture. They govern according to a cold and unpredictable machine-law that restructures all creative production along arbitrary lines of genre and spectacle. Meaning in the Algorithm Age seeks to address these 'internet pictures and their problematics to provide the basis for the further study and historiography of online vernacular artmaking.
https://symposium.foragerone.com/2023-racas/presentations/56572

Mechanical Property and Design of Multi-Material Gyroid Structures Made by Additive Manufacturing
Ladpha Teawdeswan, *Tech, Engineering, & Math*
Mentor: Guoying Dong

Abstract:
Additive manufacturing is an actively growing industry, due to the advantages it provides to design, manufacturing, and prototyping. Fused deposition modeling (FDM) being the most common because of how accessible and simple these printers are to operate different types of thermoplastic materials to be printed together. FDM technology allows

both materials to be printed together. Combing two materials together can provide material properties that are not obtainable using a single material. The materials used in this experiment are 95A TPU and PLA. TPU is a softer elastic material while PLA is a stiff brittle material. Gyroid structures are a type of lattice structure that is used to lightweight parts without decreasing the strength of a part. Gyroid structures may also offer better mechanical properties like energy absorption. Combing both of these properties can allow parts to have varying kinds of mechanical properties. The material properties of these samples are obtained by doing compression test, the data is then analyzed using polynomial interpolation to develop a neural network that will find the relative density and material distribution of a part based on mechanical properties that are desired.
https://symposium.foragerone.com/2023-racas/presentations/56595

Metabolic Dysfunction of Spinal Astrocytes Following Alphaherpesvirus Infection
Michael Corigliano*, Biomedical Sciences*
Mentor: Christy Niemeyer

Abstract:
Alphaherpesviruses, like herpes simplex virus type 1 (HSV-1) and varicella-zoster virus (VZV), are ubiquitous, with large portions of the population having been infected and latent with one or both viruses. Beyond dermatomal lesions, alphaherpesvirus infection is associated with neurodegenerative diseases like Alzheimer's disease and Amyotrophic Lateral Sclerosis. Recent evidence suggests metabolic dysregulation plays a role in the progression of many neurodegenerative diseases. Interestingly, infection may be a catalyst for immunometabolic alteration, and alphaherpesviruses have been associated with cellular metabolic changes like mitochondrial aggregation and fragmentation. While the effects of alphaherpesvirus infection have been characterized in a variety of cell types, less is known about how primary human spinal astrocyte (qHA-sps) mitochondrial network structure is affected during acute HSV-1 or VZV infection. Given that astrocytes are preferentially infected during HSV-1 and VZV reactivation and are known to become dysfunctional in neurodegenerative disorders, we hypothesized mitochondrial network morphology would be altered in qHA-sps infected with either HSV-1 or VZV. To examine morphological changes in mitochondria, we infected qHA-sps with either HSV-1 (McKrae strain; 0.001 Multiplicity of infection) or VZV (DG strain, 50-70 PFU/cm^2) and harvested cells for immunofluorescence at 1- and 3-days post-infection, respectively. We co-immunolabeled mitochondria (TOMM20) and HSV-1/VZV antigen and assessed morphology in cells positive and negative for infection; we assessed mitochondrial network area and mitochondrial network branching complexity. We found that HSV-1 and VZV infections are associated with significant reductions in the mitochondrial network area and alterations in branching complexity in qHA-sps. Additionally, our results indicate a bystander effect, whereby cells negative for HSV-1 or VZV antigen but adjacent to positive cells exhibit reductions in mitochondrial network branching complexity. Taken together, mitochondrial network changes in qHA-sps during alphaherpesvirus infection may suggest long-term metabolic shifts in astrocytes reminiscent of neurodegenerative states.
https://symposium.foragerone.com/2023-racas/presentations/56708

Metacognitive Awareness in College Chemistry
Desiree Starzyk*, Natural & Physical Sciences*
Mentor: Priscilla Burrow

Abstract:
Metacognition is a psychological tool that requires active monitoring, accurate assessment, and intentional reflection of one's own knowledge and learning process. It has been shown that students who have high metacognitive awareness are more likely to be academically successful, regardless of intellectual ability. Due to the rigorous nature of many college STEM classes, such as chemistry, implementing methods that allow students to be successful is crucial. In spite of various interventions that have been employed by college chemistry professors, these classes still suffer from high DFW rates. Over the last decades, metacognitive activities and awareness have been shown to improve memory retention, problem solving, and learning ability. This relationship was demonstrated in General Chemistry labs at Clemson University in 2009. A metacognitive awareness inventory (MCAI) was designed and validated at Clemson University, consisting of a 27 question survey measuring use of metacognitive practice in

students; The results were correlated with end of semester grades. In this study, the same MCAI was used in General Chemistry One lecture at University of Colorado Denver and was similarly correlated with grades obtained in the course. Results obtained at Clemson University using MCAI showed a low, positive correlation between metacognitive ability and academic success that was highly significant ($r(231)=0.16, p=.015$) while the research at CU Denver showed a comparable positive correlation that was not statistically significant ($r(74)=0.14, p=0.241$). Research has shown metacognitive strategies can be taught to students, but metacognitive awareness and use of these strategies seems to vary widely among college students. The lack of significance observed at CU Denver may be due to notable differences in student population between the two universities. Clemson reports that about 14% of their students are first generation, 14% receive Pell grants and 16% are minority students. At CU Denver these numbers are 50%, 26% and 36%, respectively. While data has been collected thus far, this is a continued study that going forward will include diversity questions for students to determine any advantages or disadvantages that may exist in populations, as well as expose students to metacognitive videos and exercises at the beginning of the semester to enhance their awareness.
https://symposium.foragerone.com/2023-racas/presentations/56597

Metal tolerance in the fungus *Suillus tomentosus*
Will Leary*, Natural & Physical Sciences*
Mentor: Sara Branco

Abstract:
Anthropogenic activities are a leading source of soil pollution across the globe, with metal contamination associated with mining being particularly problematic in the American West. Even though metal-rich soils are unhospitable to most species, some evolved metal tolerance and thrive in metal-contaminated environments. It is however unclear whether fungi from the Rocky Mountains are able to withstand metal pollution. We therefore investigated cadmium, lead, and zinc tolerance in *Suillus tomentosus*, a widespread fungus that is a pine tree mutualist. We expected to find that with increasing metal concentrations, the growth of *S. tomentosus* would decrease. We conducted an *in vitro* experiment testing for cadmium, lead, and zinc tolerance in *S. tomentosus* isolates collected in Colorado forests. We found that overall isolate growth decreased with increased metal concentrations. However, some isolates were able to grow at higher metal concentrations, indicating not only within species variation but also that some isolates are metal tolerant. Our results contribute to understanding metal tolerance in fungi and pave the way for future studies addressing fungal genetics and physiology in ever-changing environments.
https://symposium.foragerone.com/2023-racas/presentations/56739

Mixer Through the Roof: Implementing Musical Theater into Short Form Narrative Filmmaking
Brennan Cregan*, Arts & Media*
Mentor: Eric Jewett

Abstract:
Musicals as a film genre explore the blend of musical theater and filmography as art forms, but the parts of the sum are typically studied and explored independently and distanced from the technical and logistical undertakings in the filmmaking process. The typical course of film education contains strong emphasis on the artistic and technical aspects of typical linear narrative writing and filmmaking, causing a disconnect in understanding of traditional musical theater. In approaching the creation of our senior thesis film production titled “Mixer Through The Roof.” We researched and documented the implementation of music and choreography into our established fundamentals in short narrative filmmaking as well as the collaborative process involved. Our findings influenced the structure of our pre-production process and implemented fundamentals of musical theater, including but not limited to choreography references/documentation, choreography rehearsals, in-camera symbiotic rehearsals, and pre-recording sessions. These measures effectively blended the requirements of film on a technical audio/visual level, but would enable us to achieve the artistic and narrative beats of a film musical within the constraints of the on-set production cycle and post-production editing and sound mixing cycle, setting us up for a more fluid and efficient process over the course of the project. We argue that these implementations not only were a necessity for the

success of the film as a musical in production and post-production, but were insightful into how the glaring shortcomings in any of these pre-production stages would compound and influence production and inevitably post-production in a negative manner. We also argue that these implementations inevitably influenced our mentality and approach to traditional non-musical filmmaking positively, expanding our utilities within our more generalized focus within filmmaking as an artform.
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Model Validation and Preclinical Testing of Digestive Enzymes for Gluten Breakdown: A move to cure Gluten Intolerance and Celiac Disease
Aditi Avinash, *Biomedical Sciences*
Mentor: Aditi Avinash

Abstract:
Background: Three million people in the U.S. suffer from gluten intolerance/celiac disease (CD). While CD is an autoimmune disease that is activated by inflammation in the small intestine, gluten intolerance is due to increased sensitivity to gluten proteins. In these patients, the digestive system is not able to process and digest gluten proteins. My project aims to solve this issue.

My prior research and findings: In my previous research, I have identified three fruit enzymes that are effective and synergistic in the breakdown of gluten when combined in a 1:2:3 ratio of Papain:Bromelain:Actindin respectively (will be referred to as 1-2-3 EC MIX from now on). Based on this previous finding, I proposed two models of how the enzymes act together to degrade the gluten molecule.
Current Work: First I performed quantitative studies to validate and provide evidence for the two models proposed. I used model gliadin peptides that are most immunogenic in CD patients to see a) to what extent does my 1-2-3 EC MIX degrade these immunogenic strong peptides and b) will it inhibit reactive T cell stimulation?
Experimental strategies implemented: Immunogenic 33 mer peptides and gliadins were incubated with 1-2-3 EC MIX in different pH conditions and 1) LS/MS mass spectrometry was used to analyze gliadin peptide degradation. 2) Ran G12 ELISA and 96-well G12 antibody-coated plates to measure intact gliadin at absorbance of 450nm and gel electrophoresis for protein is used to validate mass spectral findings 3) Cytokine assays were performed using mouse IL-2 Elisa kit (R&D) to determine T cell stimulation 4) Cell growth was measured to determine the safety of 1-2-3 EC MIX in normal human T cells.
Results:

- The 1-2-3 EC MIX degraded the gliadin proteins significantly.
- 1-2-3 EC MIX significantly degraded gliadin at pH=6 and acidic pH 2-3 compared to sequential addition of the three enzymes -1/2/3 EC.
- 1-2-3 EC MIX is stable and functional in the stomach acidic environment overcoming a major challenge in oral drug delivery.
- Pretreatment of gliadin peptides with my 1-2-3 EC MIX resulted in the breakdown of gliadin proteins leading to a reduction of the reactive T-cell stimulation.
- 1-2-3 EC MIX performed better than store-bought tablets in the breakdown of gliadin.
- Pepsin alone is not enough to combat gliadin and 1-2-3 EC MIX was efficient in gliadin breakdown alone or combined with pepsin (HCI).
- 1-2-3 EC MIX is safe for normal cells.

Conclusion: Based on these findings, I am confident that this will be the solution for CD and people with gluten intolerance. This is providing me a path to move ahead to formulate the “Glu-relief pill” based on 1-2-3 EC MIX.
https://symposium.foragerone.com/2023-racas/presentations/56446

Moral Ambivalence: Listeners' Perspective On Ethics In True Crime Podcasts
Makayla Mohr, Michelle Vasquez Loya, *Social Sciences & Humanities*
Mentor: Melissa Tackett-Gibson

Abstract:
As the true crime genre continues to gain popularity, the ethics surrounding these podcasts is a topic of conversation for listeners. Our research addresses the issue of how listeners view the ethics behind podcasting and how they view their own contributions to the exploitation of victims. It also highlights the strategies listeners use to help cope with moral ambivalence. This project uses data and transcripts of listener discussions on social media. To refine our considerations, we only examined discussion boards from one primary social media platform dedicated to the podcasts Morbid and Crime Junkie. We conducted a thematic analysis with particular attention paid to parts of discussions referring to specific terms - ethics. Given this term, these are the top ethical challenges we observed in our analysis: dark and super fandoms, plagiarism, and exploitation of victims.
https://symposium.foragerone.com/2023-racas/presentations/56539

Moyocoyotzin
Madjelyn de Jesus, *Arts & Media*
Mentor: Andrew Bateman

Abstract:
This past year, I had the privilege to bring our project Moyocoyotzin to life. With our film Moyocoyotzin, which translates to “she who creates herself,” I wanted to create a deeply personal and thought-provoking film that delves into the complex relationship between a mother and daughter as they navigate the challenges of domestic abuse and the influence of Santeria in their lives.

This film draws on my own experiences growing up and explores the themes of healing, resilience, and the power of family. My intention with this project was to shed light on the challenges that many families face when dealing with domestic abuse and the lasting impact that it can have on a person's life. As someone who grew up around Santeria, I also wanted to explore the ways in which spirituality and cultural traditions can be a source of strength and healing in difficult times.
The mother-daughter relationship in the film is based on my own relationship with my mother. While our experiences were different, I wanted to capture the complexity of our relationship and how it evolved over time. We went through a lot together, and I wanted to show how we were able to find healing and strength in each other.

Santeria is a deeply personal and important part of my life, and I wanted to explore the ways in which it has helped me to navigate difficult situations. In the film, Santeria is portrayed as a source of comfort and guidance for the characters, and I wanted to show how it can be a powerful tool for healing and resilience.
This practice is something that is too often portrayed as something dark, evil, or scary by those who do not understand its origins. During our location scout, we went to many different botanicas in the Denver area, and I learned things that the women in my family never told me growing up which is that: during the slave trade when people were being brought to America, santeria was completely eradicated. People were not allowed to practice their faith and so over time; they began using catholic saints to represent the orishas in secrecy. This is how catholicism and santeria were weaved into each other as time went on.

The preservation of this tradition is just as important to me as its representation. Showcasing the ways in which this practice has saved me in this film is a radical act to protect human rights, preserve cultural heritage, and strengthen spiritual practice.

It has been an honor to work on this film with an amazing and resilient team. I have learned so much about collaboration, how to be vulnerable, and the importance of preserving these stories.
https://symposium.foragerone.com/2023-racas/presentations/56600

Neuro-Inclusive Spaces: Sensorially Supportive Landscapes
Kathryn (Katie) Finnigan, *Social Sciences & Humanities*

Mentor: Jody Beck

Abstract:
We live in a time of increasing neurodiversity awareness, which includes conditions such as autism, ADHD, dyslexia, and dysgraphia, to name only a few, as the list with similar profiles continues to expand. Some developments for neuro-inclusivity have taken place, such as ASPECTSS Design Index, yet the built environment and field of landscape architecture have yet to catch up *(Kinnaer et al., 2016).* Meanwhile, spatial and health inequities persist as ongoing issues for this marginalized group and their families. Approximately 15-20 percent of the global population are estimated to be neurodivergent, and sensory processing challenges commonly impact this population's experience of outdoor and public spaces *(Doyle, 2020; Clouse et al., 2020).* Few outdoor environments and public spaces are designed with attention to the needs of neurodivergent individuals. Meanwhile the same individuals, and their families, remain at risk of being isolated and developing significant physical and mental health problems including, but not limited to, suicidal ideation, depression, and obesity *(South et al., 2021; Zheng et al., 2017)*.
My thesis research aims to reduce environmental impacts on neurodivergent individuals and empower those who have similar struggles with sensory processing challenges, alienation, inequity, and with being invisible. The main research question is: How can outdoor environments be neuro-inclusive? More specifically, this research sets out to determine how outdoor environments can be acoustically and sensorially supportive for neurodivergent populations through design interventions and real-world applications.
To complete the research phase, I am performing a qualitative evaluation through surveys and interviews with neurodivergent individuals, family members, and professionals. The interview and survey topics are phenomenological in nature and were developed alongside professional feedback, community participation, and mentorship. I anticipate the results lending to recommended guidelines specific for planning and designing sensorially supportive public outdoor environments. The thesis portion of this project will be completed in July 2023.
https://symposium.foragerone.com/2023-racas/presentations/56577

Neuroimaging Analysis for Identifying Potential Biomarkers in Patients with Epilepsy
Zenetta Zepeda*, Biomedical Sciences*
Mentor: John Thompson

Abstract:
Epilepsy, one of the most common neurological disorders, is characterized by unpredictable seizures affecting all age groups. Due to its unpredictable nature, epilepsy can impair quality of life outside of seizure burden. These indirect effects include comorbid psychiatric disorders, cognitive deficiencies, and adverse effects of anti-epileptic medications. Additionally, untreated seizures can be fatal as well. Pharmaceutical intervention such as anti-seizure medications can be used to maintain control over seizures but is not always the most effective measure for all patients with epilepsy. Unresponsiveness to antiepileptic drugs that causes uncontrollable seizures is classified as drug refractory epilepsy. The pathogenesis of epilepsy is complicated and multifactorial, and the identification of disease associated biomarkers has been an area of active research. However, there are some forms of epilepsy that are associated with distinct structures in the brain. For example, medial temporal lobe epilepsy (mLTE) has been known to be associated with pathology in the limbic cortex. Localized brain asymmetry is one methods that has identified biomarkers and has been used to identify biomarkers in other neurologic disorders. Preforming accurate surgical intervention requires the utilization of neuroimaging analysis to localize areas of the brain affected by seizures. Implanting stereotactic EEG, (sEEG) electrodes within the brain can accurately localize of the foci of seizures. In this study, data are collected from sEEG electrodes placed within the brain from pre-operative MR and post-operative CT scans of patients with drug refractory epilepsy. This data was then analyzed by using two different automated anatomical native space segmentation routines in order to minimize error in data report. As a result, a full volumetric report was created highlighting potential regions of brain asymmetry in patients with drug refractory epilepsy to determine the correlation with disease severity and surgical outcome.
https://symposium.foragerone.com/2023-racas/presentations/56657

Non-Visual Eye Movements and Working Memory

Mohammed Aldawoodi, *Natural & Physical Sciences*
Mentor: Carly Leonard

Abstract:
Can you list three words that start with the letter C? Now count the sum of the letters of the first two words you listed. These two questions require differential engagement of long-term memory and working memory. The first question engages long-term memory more, as one must "retrieve" the words from memory, while the second engages working memory more, as one has to both hold and manipulate the prior information. Previous literature has suggested that questions such as these may evoke different eye movement rates (EMR). Specifically, tasks which require long-term retrieval, such as listing three words that start with C, typically elicit a higher-than-baseline EMR. In contrast, working memory questions, such as counting the sum of the letters, typically elicit a lower-than-baseline EMR. Interestingly, both of these questions are non-visual in nature, but still have significant effects on the way we move our eyes. Some see this phenomenon as evidence for a theory of "grounded cognition", which states that higher-level cognitive functions are "grounded" in bodily functions. In this view, long-term memory retrieval tasks elicit eye movements so that one can "search" for the information. Some studies have shown, however, that non-visual eye movements provide no functional benefit to a long-term memory task. This has led others to postulate that perhaps it may not be that memory retrieval is grounded in eye movements, but that some of the underlying neural circuitry used for eye movements is also used in memory search. If this is the case, why do working memory tasks elicit a lower EMR? What other effects does working memory have on eye movements? In this literature review, I will explore the relationship between working memory and eye movements with an emphasis on the non-visual aspects of this relationship.
https://symposium.foragerone.com/2023-racas/presentations/56606

Not The Same Anymore: Predictors of Exacerbated Self-Image in Those With Rheumatoid Arthritis
Valeria Bailey, *Social Sciences & Humanities*
Mentor: Dustin Goerlitz

Abstract:
INTRODUCTION: It is well known that rheumatoid arthritis (RA) has negative impacts on self-identity, which is linked to exacerbated health and quality of life. It is therefore crucial to elucidate factors of exacerbated self-perception in those with RA. Toward expanding that literature, we hypothesized RA severity, RA unpredictability, limited functionality, decreased ability to work, often needing to change or cancel plans, difficulty having intimate or sexual relationships, and trouble participating in physical activities to be significant predictors of exacerbated self-perception due to RA. **METHOD:** Data was collected from 3856 respondents to a national survey of those with rheumatoid arthritis in the United States (M_{age} = 60.15 years, 94.3% female, 91.1% Caucasian). Predictors of exacerbated self-perception were analyzed via hierarchical linear regression with SPSS version 28. **RESULTS:** Although significant when entered in a model alone (=.811, *p*=.044, *p*=.354). The full model showed limited functionality due to RA (=.114, *p*=.115, *p*=.197, *p*=.165, *p*=.157, *p*==.127, p^2=.390, $F_{7,3848}$=352.994, *p* **DISCUSSION:** In line with our hypotheses, all factors significantly predicted exacerbated self-perception, with the exception of RA severity when entered in the full model. This is intriguing as our results point toward decreased quality of life and functionality as stronger drivers of exacerbated self-perception, beyond RA severity alone. Future studies are encouraged to build on these results by examining mediational models to further elucidate the multi-factorial dynamic of RA and negative self-perception.
https://symposium.foragerone.com/2023-racas/presentations/55641

Novel diagnostic tools to identify underlying causes of rare genetic diseases
Kayla Medina, *Biomedical Sciences*
Mentor: Tamim Shaikh

Abstract:
Our long-term goal is to optimize diagnostic tools to identify the underlying cause of rare genetic diseases that are associated with phenotypes such as congenital anomalies, intellectual disability, seizures, and growth disturbance in

children who remain undiagnosed after multiple genetic tests. Current approaches used in clinical diagnostics include short-read sequencing of whole exomes or genomes. However, despite obtaining novel diagnoses in 26 to 40% of the patients, a vast majority of the cases remain unresolved. We hypothesize that this is due to the inability of currently used techniques to detect structural variants, including deletions, insertions, and inversions, in the genome. To overcome this challenge, we are using techniques that allow the analysis of relatively long fragments of DNA, which allow better detection of structural variants that may play a causal role in the observed disease phenotypes.
https://symposium.foragerone.com/2023-racas/presentations/56714

Oral Health Care Service Associated with Risk Behaviors and Experiences among Black Youth – Youth Risk Behavior Survey (YRBS), 2019
Kenyatta Richardson*, Social Sciences & Humanities*

Abstract:
Oral health is an important factor in the overall health of adolescents. The purpose of this study was to identify sociodemographic and health risk behaviors of Black high school students in the United States who reported to have never seen a dentist. Methods: Secondary data analysis was conducted utilizing the 2019 Youth Risk Behavior Survey (YRBS) to examine factors associated with oral health care service utilization. Results: Among 13,677 students who took YRBS 12,468 in total answered the question "When was the last time you visited a dentist? ” Black students Discussion: The results suggest the influence of non-utilization of oral health care services by Black high school students. These results may be considered useful to those who influence policy affecting the distribution of preventative oral health care services
https://symposium.foragerone.com/2023-racas/presentations/56651

PFAS Contaminated Groundwater Impacts on Fish Hepatic Histology
Leah Lusk*, Biomedical Sciences*
Mentor: Alan Vajda

Abstract:
This research examines the exposure of endocrine disrupting chemicals (EDCs) in fathead minnows to better understand the effects of environmental toxicology in fish. During 2018 and 2019, mobile laboratory experiments were conducted to exposed fish of waters containing chemicals from a nearby legacy fire-training area (FTA). Liver samples were collected and investigated to identify the pathologies occurring due to chemical exposure. The FTA is a known source of per- and polyfluoroalkylated substances (PFAS) which are environmentally persistent and highly mobile in groundwater. Hepatic histology of male and female fish exposed to FTA-contaminated groundwater was compared to that of fish exposed to relatively uncontaminated reference water (REF). The fish living in these conditions show morphological changes in their hepatocyte histopathology, although the exact lethality and concentration of pollution is unknown. Livers were microscopically evaluated for the occurrence and severity of apoptosis, degeneration, congestion, sinusoidal distention, hepatocytic hypertrophy, and lipid vacuolization in four different fields of view. Slides with dominant representations of these conditions were compared to seemingly healthy hepatocytic characteristics and found to be identifiable through consistent assessments. Results of site-specific histopathological evaluation will be presented. The exact chemical causes and toxic substances in the water are not known and will be identified in future works using lab screenings. Conducting this investigation on the effects of EDCs on a model organism like the fathead minnow is important in integrating research for the same exposure and effects in humans. The impacts caused by the chemicals that are contaminating water that may be consumed by populations living in these areas may have adverse implications for human health. The significance of exposing the harmful effects of EDCs such as PFAS could lead to removing them from FTAs and other disposal sites and inspire the use of safer alternative treatments. This analyzation is highly valuable in endocrine disruptive studies on direct hepatic toxicity.
https://symposium.foragerone.com/2023-racas/presentations/56567

PFAS effects on reproductive system of freshwater fish
Anshu Mehta*, Biomedical Sciences*
Mentor: Alan Vajda

Abstract:
Per- and polyfluoralkylated substances (PFAS) are a group of man-made chemicals with potential adverse impacts on reproductive and metabolic health in exposed humans and wildlife. To evaluate how PFAS exposure affects reproductive health of fish, Dr. Vajda's team had conducted a series of on-site fish exposure experiments at a well-characterized PFAS-contaminated site at Joint Base Cape Cod, MA.
The study species was the fathead minnow (Pimephales promelas), a native North American freshwater fish that is a widely used model organism for ecotoxicological studies. Male fathead minnows were exposed for up to 21 days to groundwater contaminated with high concentrations of PFAS, water from an uncontaminated reference site with low concentrations of PFAS, and mixtures of contaminated and uncontaminated water. Water and tissue samples were collected to evaluate occurrence and effects of PFAS and co- occurring contaminants. Preliminary findings suggest that the cell-cycle in fish testes is sensitive to the effects of PFAS and may be a suitable predictor of human and ecological risk. Expression of immunohistochemical markers of cell-death and cell proliferation indicated testicular toxicity. Microscopy and qualitative assessment of testes histology indicate the dominant spermatogenetic stage of testes varied between sites showing how cells and their abundance may be linked to site-specific environmental contaminants. Results will also be presented for secondary sex characteristics, organ-somatic indices, and plasma vitellogenin. Thus, through various factors a comprehensive picture of the effects of PFAS will be presented at RaCAS.This research uniquely addresses PFAS impacts in the context of complex environmental mixtures and informed assessments of PFAS hazard to human and ecosystem health.
https://symposium.foragerone.com/2023-racas/presentations/56699

POKY DOCK for Efficient In-Silico Drug Screening with Herbal Medicine Libraries
Mikayla Truong*, Biomedical Sciences*
Mentor: Woonghee Lee

Abstract:
In-silico screening is a time and cost-efficient method for drug development. Nuclear magnetic resonance (NMR) titration and quantitative structure-activity relationship (QSAR) methods are important tools for predicting the biological effect of chemical compounds. NMR titration is particularly useful for producing and screening drug candidates, as it can identify weak-binding compounds and potential binding sites of ligands on a target protein through the analysis of chemical-shift changes of the protein in response to ligand titration and the structure of each molecule. Our group has developed POKY, a software suite for multidimensional NMR analysis that includes an in-silico screening program for drug design, known as POKY DOCK. This program computationally predicts how a small molecule ligand binds to a target protein. To advance this program, we propose the integration of herbal medicine compound libraries from various Asian countries, including China, Korea, and Vietnam. This integration will enable users to check for potential drug-like inhibitors that could bind to their specified receptor protein within the compound databases. In this process, POKY DOCK will allow the program to analyze the binding capabilities of a receptor with multiple ligands, creating an efficient in-silico screening software. This program, combined with the other NMR analysis capabilities of POKY, will allow for NMR data analysis and in-silico screening within the same software suite. This development would create a more operative tool for drug development by identifying potent herbal or chemical compounds that could bind to a target protein and function as an inhibitor to treat different illnesses.
https://symposium.foragerone.com/2023-racas/presentations/56650

Political Risk Insurance

Orin Crouse*, Tech, Engineering, & Math*
Mentor: Erin Austin

Abstract:
Political Risk Insurance (PRI) for Canadian Oil and Gas companies. The examination is to determine whether these companies should seek out PRI with results that hope to show the benefits or consequences. Having the conditions of the country's influence from the business cycle, rare world changing events, and federal elections. Simulations that have changes in probabilities and random distributions to cover possible outcomes and repeat a thousand times. The results show that the rare usage of PRI is simply a lack of knowledge. Another finding is that from a policy point of view, companies see an ebb and flow with revenue. So, why spend money in attempt to sway the outcome of elections if it is shown to futile.
https://symposium.foragerone.com/2023-racas/presentations/56506

Practical inductors
Michael Demetrescu- Vulcan*, Natural & Physical Sciences*
Mentor: Michael Rogers

Abstract:
Coils are used all around our daily modern lives. They are in power delivery, communications, sound, automotive, transportation and many other places around us. A multitude of sensors already use coils to sense and understand the world. Exploring the uses further and how these coils behave at their resonant frequencies was the goal for my research. Thinking on further uses for coils and inductors we decided to explore their underlying physics and phenomena that govern their behavior. Using Maxwell's equations and Stokes theorem to explain inductance of a coil, how to make precise coils, and applying these coils to the real world was the task that was taken on in my undergrad goals.
https://symposium.foragerone.com/2023-racas/presentations/56655

Printer Head
Connor Gawkoski, Frances McIlvain*, Arts & Media*
Mentor: Andrew Bateman

Abstract:
Printer Head is a surreal psychological horror story embodying the isolation and anxiety of our uneasy times, taking us into the world of a lowly office accountant who is thrust into mayhem as he rushes to get an important document printed by the end of the day. In addition to the many FITV students who have lent their help to this project, we have been lucky to be work with two students from the Music and Entertainment Studies program who captured all our location audio and will be key collaborators as we explore opportunities for post-production sound and musical scoring.
This is a fable about a shy, lonely young man who longs for friendship and acceptance, but is often overtaken by the brutality of city living. He finds what he is looking for but not in the way he initially thought. This is a character we designed to reflect ourselves and many of our peers who have struggled to find security and carve out a sense of self after two years of a pandemic that has interfered with much of our time to be together and better understand one another. This story illustrates how we can find family and community in the most unlikely places. Our film upholds the values of CU Denver by demonstrating to audiences that we all deserve empathy, acceptance, and a place to belong.
https://symposium.foragerone.com/2023-racas/presentations/56692

Pro-inflammatory effects of pine wood smoke particles on a human bronchial epithelial cell line
Vincent Conrad*, Biomedical Sciences*
Mentor: Alison Bauer

Abstract:
Wildfires are a common natural occurrence that release a significant amount of particulate matter into the environment. Particulate matter is one of the most important causes of increased morbidity and mortality in patients with chronic inflammatory airway diseases like asthma or COPD, as well as a potential carcinogen. Due to fluctuations in temperatures and climate changes, a trend toward more annual wildfires has been significantly increasing public wildfire smoke and hence particulate matter exposure, thus creating the necessity for additional studies on woodsmoke particulate matter (WSP) toxicology using relevant tissues such as lung airway epithelium. This study aimed to investigate the adverse effects of pine WSP generated at the Center for Energy Development and Health at CSU using an immortalized, non-tumorigenic human bronchial epithelial (BEAS2B) cell line. These pine WSP are a surrogate for wildfire smoke exposure. We evaluated cytotoxicity (0-100 ug/ml (ppm) WSP) after a 24 h exposure using MTS and LDH assays. We then identified a non-cytotoxic dose to be used for IL8 cytokine secretion and quantitative RT-PCR assays to measure pro-inflammatory markers (cyclooxygenase 2 (*COX2*), cytosolic phospholipase A2 (*cPLA2*), and *TNF)*. We determined that doses of 50 ug/ml WSP and higher were cytotoxic to the BEAS2B cells using both assays. Twenty-four hours following a non-cytotoxic dose (25 ug/ml) of WSP, IL8 cytokine secretion was significantly increased. The mRNA expression levels of the acute inflammatory marker *TNF* trended towards an increase 24 hours following WSP treatment compared to controls, however neither *cPLA2* nor *COX2* were changed. Results suggest that pine WSP are a significant inflammagen for lung bronchial epithelium, and further studies are needed to determine the signaling pathways involved for potential therapeutic interventions to reduce adverse effects of WSP.
https://symposium.foragerone.com/2023-racas/presentations/56609

Protein Modification Induced by Oxidative Stress Compounds in Insulin-Secreting Cells
Isaiah Lowe*, Biomedical Sciences*
Mentor: Jefferson Knight

Abstract:
In type 1 diabetes, pancreatic islets are targets of inflammatory immune cells resulting in the overproduction of reactive oxygen species (ROS) and the eventual death of the β-cells which are normally responsible for insulin secretion. ROS are produced naturally in the body; however, if these species are not neutralized, they can react with and damage cellular proteins and other macromolecules. β-cells naturally lack key antioxidant enzymes, making them easy targets for ROS. It is known that β-cells and the proteins they contain are modified during oxidative stress, but how damage to particular proteins leads to loss of insulin secretion is not understood. Previous experiments in our lab used a proteomic approach to identify several secretory and signaling proteins in β-cell lines that react with lipid aldehydes such as 4hydroxynonenal (4HNE). In order to verify these modifications, we used a technique known as Western blotting. Rodent β-cell lines or pancreatic islets were exposed to 4HNE or cytokines to Induce modifications that occur during oxidative stress. Proteomic analysis and Western blotting were then used for detecting and identifying modified proteins. We observe both known modified proteins such as AKT well as previously unknown modifications on proteins such as SLP5. The results from this project will help to give insight to the various impacts that inflammation and oxidative stress have on pancreatic β-cells in early stages of type 1 diabetes.
https://symposium.foragerone.com/2023-racas/presentations/56605

Pseudo Gradient Viability in Total Field Magnetometry
Clayton Ridder*, Natural & Physical Sciences*
Mentor: Michael Rogers

Abstract:
This project uses computational methods to compare data from two types of archaeological sensors. There has been long standing debate within the Geophysical Archaeology community regarding the benefits of two magnetic field detectors; the fluxgate gradiometer and the optically pumped cesium magnetometer. Gradiometers are comprised of two magnetic field sensors with a fixed separation. Data from the sensors are subtracted to create a

gradient of the magnetic field. This removes the Earth's magnetic field from the data such that archaeological sources can be focused on. On the other hand, total field instruments are comprised of a single sensor. Two total field instruments can be set up to record data at a fixed distance from each other, such that they can also measure the gradient of the magnetic field. While both instruments can measure the gradient of the magnetic field, there are logistic complications associated with either instrument. The fixed separation of gradiometers makes them difficult to transport, and placing a total field sensor into gradient mode requires dedicating a second sensor to the new sensor set up. If there are a limited number of total field sensors available, using a second sensor for gradient mode will decrease the speed that data can be collected. The goal of this project is to use a method called upwards continuation to simulate the gradient of the magnetic field using a single total field sensor. This would provide the benefits of a gradiometer without the need of a second sensor. Data were collected in both north America and Europe with a fluxgate gradiometer and an optically pumped cesium magnetometer in order to observe variation between continents.
https://symposium.foragerone.com/2023-racas/presentations/56659

Psychophysiological Responses to Anti-Immigrant Rhetoric: A Mixed-Effects Experimental Study among University Students
Annemarie Dupuy, William Navarrete Moreno, Dien Thinh Nguyen, *Social Sciences & Humanities*
Mentor: Jennifer Morozink Boylan

Abstract:
The increasing prevalence of anti-immigrant rhetoric in media, policy, and everyday life has raised concerns about its potential impacts on psychological and physiological responses. This study examines the relationship between exposure to anti-immigrant rhetoric and psychological stress, as well as cardiovascular responses (heart rate, systolic blood pressure, diastolic blood pressure), considering participants' "social distance" to immigrants using a within subjects design. A total of 59 participants were recruited from a university's psychology department, and a digital sphygmomanometer was used to monitor their physiology during exposure to anti-immigrant and neutral museum rhetoric. Results showed significantly higher psychological stress after exposure to anti-immigrant rhetoric (M = 4.31) compared to neutral museum rhetoric (M = 3.39), t(58) = -4.80, p
https://symposium.foragerone.com/2023-racas/presentations/56744

Public Outreach in Peace Advocacy: Best Practices
Seth Harris, *Social Sciences & Humanities*
Mentor: Martin Widzer

Abstract:
In a media landscape defined by politically charged news, it has become harder to come across nuanced information on the world's conflicts. Thus, it has become increasingly important for peace advocates to challenge unreliable narratives. However, with limited resources, it can be difficult for small organizations to confront these narratives directly. These organizations have found that the best way to address this issue is to avoid competing in the same media spheres that produce misleading content. After analyzing the websites of a broad variety of organizations, it was evident that the most common way to provide counter-narratives is through conflict reports. These can provide a more in-depth, nuanced understanding of a conflict than is possible with most news media. Furthermore, these require significantly fewer resources and experience than other forms of media, such as short films. In this study, I have analyzed reports provided by other advocacy groups, and applied common practices used by said groups to develop a report on the conflict in Ukraine. In doing so, I found that peace advocates can best reach their audiences by writing reports that balance the benefits of brevity and nuance.
https://symposium.foragerone.com/2023-racas/presentations/56493

Quantitative musculoskeletal ultrasound: The effect of gain and probe angle on greyscale levels and texture analysis

Daniela Gonzalez-Rivera, *Biomedical Sciences*
Mentor: Michael Harris-Love

Abstract:
Sarcopenia is a condition characterized by a loss of muscle mass and strength. Currently, there is no standard screening approach for muscle health in the clinical setting, leaving sarcopenia underdiagnosed. The use of ultrasound imaging has been proposed as a measure of muscle quality. Echogenicity can determine muscle quality. However, ultrasound probe angle and the gain settings affect the image quality, affecting the echogenicity, or grayscale values. We propose the use of grey level of co-occurrence matrix (GLCM), a second order statistical texture analysis approach, to measure muscle quality. We believe this method would be more resistant to angle and gain changes than grayscale value and may be a better predictor of muscle performance. The purpose of this study is to determine the variability between gain changes and angle changes of GSL and GLCM. We then aim to determine which GLCM texture element is least influenced by the gain and angle changes. Ultrasound images with gain settings of 0 to 10 and the probe's angle from -50 to 50 degree were taken of a memetic phantom device, which mimics muscle tissue. The GSL and GLCM values were measured. Between the different gain settings, GLCM measures had less variability than GSL, specifically, GSLM element entropy (ENT) (CV=10.5%) and inverse difference moment (IDM) (CV=16.5%) compared to GSL variability (CV=39%). The probe's angle did not have much variability for echogenicity (CV=6%), and ENT had even less variability (CV=3%) similar to IDM (CV=4%). This shows that GCLM was less affected by those changes than GSL. We then examined the associations between GLCM elements with muscle strength (grip strength tests) from Long Life Family Studies with ultrasound scans of the carotid artery and sternocleidomastoid. Analysis with GLCM showed to be an appropriate predictor of muscle performance. ($r = .453$, $F = 3.9$, $p = .032$).
https://symposium.foragerone.com/2023-racas/presentations/56759

RELAQS: Research and Education with Low-cost Air Quality Sensors

Brady Graeber, *Social Sciences & Humanities*
Mentor: Ben Crawford

Abstract:
Spatially distributed networks of low-cost air quality sensors have tremendous potential as educational tools to give students the opportunity to learn about atmospheric sciences in a sensory format. However, studying how these low-cost sensors help students meet learning goals has been a relatively untouched topic in scientific and educational research. During phase 2 of this ongoing project, we attempt to further address this gap in knowledge by deploying low-cost air quality sensors in high school Advanced Placement (AP) groups to evaluate how using sensors and online databases affects learning outcomes. The custom-made sensor kits measure VOCs and particulate matter (PM2.5). Each unit uses both solar panels and a rechargeable battery to power an air quality sensor and a cloud-based motoring chip. The cloud-based chip transmits measurements to a downloadable online database where data can be visualized in real-time. Sensors are then calibrated against reference monitors to preserve data integrity. For this research, new classroom activities incorporating the sensors and their data are designed to meet specific US NGSS (Next Generation Science Standards) and AP standards. The phase 2 study group includes 60 students, 4 classes, and both traditional and non-traditional air quality experiments. Phase 1 of this project showed that students not only preferred using the low-cost air quality sensors but also that they had a higher retention of knowledge learned while participating in the lab experiment. Our goal for phase 2 is to repeat this project on a larger scale to create a statically meaningful data profile.
https://symposium.foragerone.com/2023-racas/presentations/56723

***Reunirse* - Understanding Mexican Undocumented Immigrant's Plight and Identity**

Teej Morgan-Arzola, *Arts & Media*
Mentor: Andrew Bateman

Abstract:
Raúl (Tanis Joaquin Gonzales), a Mexican farmhand migrates to America to better support his family, but his dream crashes to the ground when his wife Carmen (Bella Romero-Karlek) and daughter Jackie (Elyse Rivera) can't meet him across the border. With the help of his friend, Armando (Angelo Mendez-Soto), they both try to find comfort by celebrating the Day of the Dead.
Reunirse supports a bold collaborative idea presented as a Spanish-speaking film, achieving thematic elements concerning humanitarian aid and what it means to find one's cultural identity. It is a junior thesis short film (10-minute length) for the Department of Film and Television (FITV) at the University of Colorado Denver (CU Denver).
The intended objectives of *Reunirse* are to bring passionate and committed artistic students together to manifest serious concepts. Too often, black and brown stories are about their trauma, but Reunirse distances itself from this norm as it acknowledges that racial minorities experience traumatic events, but it is not their identity. Yes, this is a story that portrays immigration across the Mexican-American border, but we want our viewers to see this as a humanitarian issue. The intended outcomes are to showcase the plight of undocumented immigrant families, offer a platform for Latinx voices, and synthesize the importance of family. We will also contribute to local networking by involving a diverse crew/cast.
Reunirse was created with purposeful meaning with a relevant cause, and rarely these stories are produced in the film industry. It will certainly disrupt the mainstream plots that are normalized in the film business. When translated into English, our film title *Reunirse* means *To Come Together Again*. The name of this project itself is straightforward, but it focuses on the opportunity to come together and share a story about unity. Our title is rooted in our production plan, the theme, and the character's goals. It is not a coincidence that one of the most unifying holidays Dia De Los Muertos (Day of the Dead) makes an appearance and is relevant to Raùl's development and purpose. With the support of the school, FITV staff, and our team, we look forward to watching Reunirse on the big screen over and over again in 2023.
https://symposium.foragerone.com/2023-racas/presentations/56911

Role of Immune Cells Regulation in Rheumatoid Arthritis

Masodah Sherzad, *Biomedical Sciences*
Mentor: Kristin Sturm

Abstract:
Rheumatoid Arthritis (RA) is an inflammatory and systemic autoimmune disease whose exact cause is unknown, although environmental and biological risk factors have been identified. RA leads to inflammation and degeneration of joints, impacts the quality of life, and increases mortality. Around 0.5–1 % of the adult population is affected by RA, and women are more likely to develop RA compared to men. Multiple drugs are approved to treat RA, but many patients do not respond to therapy or become non-responsive over time. It is important to understand RA on a biological level because it involves a complex interaction of immune cells in areas where RA could develop, such as in the joints of the hands, wrists, and knees. Insight into these complex interactions could guide the development of new drugs to treat or prevent RA.
Factors such as the generation of autoantibodies, genetics (e.g., protein sequence that increases the risk for developing severe RA), environmental exposures (e.g., smoking), and imbalance of immune cell function contribute to RA. Environmental or genetic factors eventually culminate into immune cell dysfunction. Hence, dysregulated immune cells are a predominant factor in the development and progression of RA. The immune system can be activated in many ways, one of which is recognition and response to antigens, which are proteins or sugars located on the surface of normal cells and foreign pathogens. Sometimes, antigens on normal cells are not recognized as such, triggering immune cells to attack healthy cells by mistake, leading to autoimmune diseases like RA.
There is no cure for RA; currently, available treatments aim to control the symptoms and prevent joint damage. Considering the central role of immune cells in RA, their manipulation has been targeted in RA treatment. I will discuss treatments and their pros and cons in RA.
https://symposium.foragerone.com/2023-racas/presentations/56779

Secretory Protein Malfunction following Malondialdehyde Modification

David Soto, *Natural & Physical Sciences*
Mentor: Jeferson Knight

Abstract:
Type 1 diabetes is a life-threatening illness that affects the lives of approximately 1.45 million Americans. This disease arises when immune cells invade pancreatic islets, which causes inflammation and loss of insulin secretion leading to death of the β-cells that produce insulin. We are interested in understanding how inflammation-mediated protein damage initiates, the loss of insulin secretion. During inflammation, the intracellular production of reactive lipid aldehydes is stimulated, including 4-hydroxynonenal and malondialdehyde (MDA), which are known to covalently react with proteins in the cell. This process is called protein carbonylation and can introduce changes in protein structure and function. We have previously treated insulin-secreting cells with reactive aldehydes and identified proteins that became carbonylated. Preliminary proteomic data indicate that synaptotagmin-like protein-5 (Slp-5), a membrane-binding protein in the secretory pathway, is a target for protein carbonylation in these cells. Based on prior studies with a similar protein, we hypothesize that the modifications occur on lysine-rich clusters in the membrane-binding C2 domains. Therefore, the objectives of this project are to clone and purify the two C2 domains from Slp-5, modify them with MDA, and test the effects of this modification on protein structure and function. We predict that carbonylation by MDA will decrease the protein's ability to fold correctly and/or to bind to its target lipid membranes. Thus, we will first characterize the membrane binding affinity and lipid specificity of Slp-5 C2 domains using a well-established liposome binding assay. Then we will react the C2 domains with MDA. If Slp-5 C2 domains remain soluble after carbonylation with MDA, we will test how well the modified C2 domains bind membranes compared to the unmodified C2 domains. The results of this study will shed light on how inflammatory stresses damage activity of Slp-5 and similar proteins in the insulin secretory pathway.
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Sex Related Gene Expression Differences for Heart Failure and an Injectable Carbon Nanotube-Functionalized Hydrogel as a Tool for Cardiac Tissue Engineering

Maydha Kumar, *Biomedical Sciences*
Mentor: Brisa Pena

Abstract:
Introduction. Heart failure (HF) contributes significantly to the global burden of cardiovascular disease. Although, the data suggests that HF pathogenesis differs between sexes, therapies for HF continue to be applied similarly to both men and women, despite most data were derived from predominantly male-population studies. The goal of our project is to develop the first understanding of the normal and diseased sex-specific heart transcriptomes and assess an engineered injectable reverse thermal gel (RTG) functionalized with CNTs (RTG-CNT) as a potential tool for cardiac tissue engineering.
Hypothesis. There are important sex-specific pathways associated with biomechanical signaling that differ between sexes and this can be used to engineering therapies for heart failure.
Methods. Our team has a unique transcriptome human heart NHLBI TOPMed dataset (~750 paired DNA/RNA sequenced human heart samples), with both sexes. For this project, we will identify cardiac genes that differ in NF hearts between sexes, using Ingenuity Pathways Analysis (IPA) software. Moreover, a short-term (4-week) regeneration experiment using our RTG-CNT hydrogel as a miRNA delivery system was also performed and assessed in a mouse model (intracardial injection).
Preliminary Results. For our preliminary results, we found by atomic force microscopy (AFM) that there are sex-differences regarding the biomechanics of human hearts and by IPA that there are sex-specific differences regarding the metabolic pathways in ischemic hearts. Furthermore, we found that although the RTG-CNT hydrogel-miRNA was well tolerated in male mice, a significant number of female mice did not survive the hydrogel treatment nor the injections of the controls (saline solution and lipofectamine).
Conclusions: These data validate the use of gene expression analysis to identify signaling pathways differing between sexes in hearts. although the RTG-CNT has potential to be used as a miRNA delivery system, further modifications need to be made to implement it in females.
https://symposium.foragerone.com/2023-racas/presentations/56685

Sex-Dependent Neural Circuit Control of Voluntary Physical Activity
Nadja Brown*, Natural & Physical Sciences*
Mentor: Benjamin Greenwood

Abstract:
Understanding the brain circuits that contribute to the maintenance of exercise, particularly rapid escalation of exercise behavior in female rats, could help maximize the benefits of exercise. When allowed voluntary access to running wheels, rats escalate running distance daily during the acquisition phase, until reaching a plateau in daily running distance during the maintenance phase. Female rats escalate more readily and reach greater absolute daily running distances than do males. Substantia nigra (SN) projections to the dorsal lateral striatum (DLS) have been implicated in motor activity and habit behavior, but the role of the SN-to-DLS circuit in acquisition and maintenance of voluntary exercise has not been investigated. The goal of the current experiment is to determine the role of the SN-to-DLS circuit in the acquisition and maintenance of voluntary exercise and whether sex differences exist. We hypothesize that the SN-to-DLS circuit is responsible for the maintenance of voluntary exercise behavior. Moreover, given that females can develop DLS-dependent habitual responding during operant training more readily than males, we also predict that the SN-to-DLS circuit drives voluntary wheel running earlier during the acquisition phase in females compared to males. An intersectional chemogenetic approach was used to silence the SN-DLS circuit during daily voluntary wheel running in male and female rats. This is the first time a circuit-specific approach has been used to investigate neural circuits underlying exercise behavior. Inactivating the SN-to-DLS circuit reduced wheel running in both sexes without impacting locomotor activity, per se. Circuit silencing reduced nightly distance run in females starting from the first day of wheel access. Interestingly, silencing had no effect on daily distance run in males until several weeks after the start of wheel access. These data suggest that there are sex differences in the role of the SN-to-DLS circuit in the acquisition maintenance governing of voluntary exercise.
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Siblings' Experience: Development and Racial-Ethnic Socialization
Cecilia Yamas, Celeste Swehla*, Social Sciences & Humanities*
Mentor: Jennifer Camacho Taylor

Abstract:
This literature review aims to utilize a family lens in exploring the impacts multiracial siblings may have on each other's socio-emotional and cognitive development, although this was the aim we were able to conclude that not much research has been conducted to understand this specific population which is one of the reasons this work is important. Our review of the literature was guided by two research questions: (1) What developmental implications do siblings have on each other? and (2) What racial-ethnic socialization (RES) experiences do families navigate with multiracial/multiethnic children? Additionally, Bowen's Family Systems Theory and Brofenbrenner's Bioecological Theory will be applied when examining the above research questions. We conducted a systematic literature review over the past four months by gathering information on sibling relationships using the keywords, siblings, siblinghood, and sibling development, centering on our first research question. Addressing the second research question, the following keywords were used: siblings' impact on RES, multiracial families' socialization, and multiethnic-racial identity development. While working on the literature review, we did not focus on age parameters but know that our data collection will focus on emerging adults. From our current work, we were able to conclude that siblings impact each other's development by serving as teachers, role models, and key units in familial support systems. Other content that emerged connected to the first research question was mutual identity formation processes and differences in sibling dynamics/responsibilities due to sibling order. Lastly, regarding our research question centered on RES experiences, we found that most work focuses on parent-child socialization practices, however, significant influence can stem from sibling interactions. Therefore, the implications of this work are the nuances among this population needing understanding as gaps in research remain. Our goal is to offer support in closing such gaps via future fieldwork and data collection.
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Silain: A Proton/Sialic Acid Co-transporter
Eric Wooten, *Natural & Physical Sciences*
Mentor: Hai Lin

Abstract:
Sialic acids are a group of diverse compounds that are essential to many biological processes related to the interaction between cells, immune responses, protein stability, and more.[1,2] They are translocated across membrane by sialin, a proton/sialic acid co-transporter. Malfunctions of sialin cause accumulation of sialic acids that lead to lysosomal storage disorders (Salla disease and infantile sialic-acid storage disorder ISSD), which have no cure today.[1,2] Deciphering the operating mechanism of sialin allows a better understanding of how mutations affect the transport of sialic acids, potentially leading to therapeutic treatments. Here we report our preliminary study of comparing the AlphaFold outward facing protein structure to the experimental inward-facing protein structure along with the sialic acid substrate docked using Autodock Vina. These results will allow us to build an accurate atomistic model of sialin embedded in a lipid bilayer membrane, which will be employed for subsequent dynamic simulations to pinpoint the interplays between sialic acid, proton, and key residues during the substrates transport processes.
https://symposium.foragerone.com/2023-racas/presentations/56610

Simple Steps for SciComm Success
Zachary Courter, *Natural & Physical Sciences*
Mentor: Gregory Ragland

Abstract:
The internet age has brought new advantages for all kinds of communication, with information traveling faster and farther than ever before. However, this medium is underused by the various fields of science. This project seeks to demonstrate the capabilities of science communication, by creating an informational video highlighting the Ragland lab's CURE (Core-based undergraduate Research Experience) program, a program offered to students that provides authentic research experiences during a laboratory course. I have designed the video to act as a quick and simple way of introducing anybody, regardless of their scientific knowledge, to the goals of a CURE, how it's done, and the bigger scientific picture that the research fits into. The Methods of this project involved working with the Ragland Lab to gain an in-depth understanding of the CURE project before conducting recorded interviews with lab personnel. A draft for a script was then written up and used to determine the footage that needed to be gathered, such as video of the lab work being covered, and interviews with lab personnel. As the project progressed, I conducted interviews, recorded footage, and recorded voice overs. I used the Adobe editing programs Premiere Pro and After effects to bring all the pieces together, and also to create a professional and informative appearance and flow for the video. The intent of creating a video such as this is to provide the Ragland lab with an easy and effective way to advertise and showcase their CURE program, either to prospective students, or for groups at other universities who might be curious about replicating this particular program. This project can also act as a demonstration of the simple workflow that can be replicated to produce similar informative content about other CUREs, Courses, or other types of scientific content offered by universities in the future.
https://symposium.foragerone.com/2023-racas/presentations/56639

Social determinants of contraception counseling for women with rheumatic diseases
Jazmine Ames, *Biomedical Sciences*
Mentor: Kristin Sturm

Abstract:
Females of childbearing potential are disproportionately affected by systemic autoimmune diseases and encounter health choices that are more complicated than those of the average person. Many medications used to treat systemic autoimmune diseases have suspected or confirmed teratogenic effects. Teratogenic medications are

known to cause birth defects, and as a result, providers prescribing these medications need to provide counseling for effective contraception. Contraceptive counseling should be an integral part of clinical care for individuals with rheumatic diseases to allow patients to make informed healthcare decisions. Social and demographic factors play a role in the biases patients experience in the healthcare system. Therefore, an obvious conclusion would be that these factors also affect contraception counseling. Most people believe contraception counseling is the responsibility of a patient's gynecologist. However, non-gynecologist specialists also need to be knowledgeable and provide effective contraception counseling. Specifically, patients with chronic medical conditions who take potentially teratogenic medications need to be informed of the risks the medications hold for a developing fetus and the importance of using effective contraception. Because of the importance of contraception counseling for patients with rheumatic diseases, we investigated the potential effect of provider and patient demographics (eg, age, sex) and social determinants (eg, race, insurance type) on the counseling provided/received. Females of childbearing potential (18-50 years) with an established diagnosed rheumatic disease who were English-speaking were invited to complete online questionnaires. Respondents were asked about contraception counseling received as part of their routine care. An anonymous online questionnaire was also given to clinical providers. We hope to demonstrate whether demographics or social determinants affect counseling and, if so, what factors play the biggest role in this relationship. This will help us guide efforts to improve care and arm patients with the knowledge to avoid unknowingly causing harm to a developing fetus.
https://symposium.foragerone.com/2023-racas/presentations/56656

Soviet Legacies in the Czech Gender Experience
Zoe Vavrina*, Social Sciences & Humanities*
Mentor: Martin Widzer

Abstract:
The Czech lands' unique location between the West and the East makes it an important case study to apply postcolonial feminist theory. As Soviet Satellites, the Soviets influenced the laws regulating maternal leave, pay discrimination, contraception, and marriage which shaped Czech Women's gender experience. Given this context, my primary question is: to what extent did Soviet imperialism effect Czech women's experiences? I hypothesize that Soviet imperialism is correlated with Czech women's gender experience. This study uses mixed methods, focusing on analysis of secondary sources and descriptive statistical analysis to assess how Soviet imperialism effects Czech women's gender experiences. The Velvet Revolution in 1989 is a critical juncture that ended Soviet imperialism and therefore directly impacted Czech women's gender experiences. This study compares two temporal cases to determine the effect of Soviet imperialism on Czech women's gender experience.
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SSIM: Computer Vision-Based NMR Strip Matching for Backbone Chemical Shift Assignment
Zowie Werner*, Biomedical Sciences*
Mentor: Woonghee Lee

Abstract:
Nuclear magnetic resonance (NMR) spectroscopy is a technique observing aligned nuclear spins excitations and relaxations by radio-frequency pulses in a strong magnetic field. It is a useful powerful tool for characterizing the structures and dynamics of a protein in a cellular physiological-like state at the near-atomic level. One of the most challenging steps in NMR spectroscopy is the NMR assignment process, which involves matching NMR signals to atoms in a protein. Traditionally, this can be accomplished by a forward or backward walking strategy, which necessitates peaks picked on the spectra by the individual. NMR assignment is virtually impossible because there are thousands of signals, peak overlaps, weak signals, peak broadening, and more. To remedy this issue our group develops POKY a software suite for multidimensional NMR and 3D structure calculation of biomolecules. We have developed and adopted an SSIM computer vision (CV)-based image-matching algorithm that has eliminated the need for the peaks to be picked by the individual user. The POKY software suite uses strip plots to display and analyze NMR data, consisting of narrow sections associated with residues. The SSIM algorithm cycles through these strips rather

than peaks, which allowed for more efficient matching and connecting of residues in the protein assignment. By analyzing the similarities between strips, the SSIM algorithm can identify matching residues without the user needing manual peak picking. This approach simplifies and accelerates the NMR assignment process, making it possible to analyze complex biomolecules with thousands of signals and peaks. We plan to continue developing and improving this algorithm to further the accuracy and reliability of the algorithm, as SSIM is newly developed. This novel technology has the potential to significantly accelerate and advance NMR-based protein structure research.
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Structural Studies of the -GGAG- Tetraloop within Hairpins of DNA & RNA
Vi Tho Nguyen, *Natural & Physical Sciences*
Mentor: Marino Resendiz

Abstract:
DNA and RNA can hybridize as duplexes with distinct conformations such as A-, B-, or Z-form; as well as adopt various structural motifs like hairpins or internal loops. These play important roles in biology and can serve as recognition sites for other biopolymers or metabolites. In this work, we set out to explore the structural impact of the -GGAG- tetraloop within hairpins of DNA and RNA. Seventeen dodecamers were prepared to systematically explore the structural changes on the hairpin, where the sequence of the stem, and the loop was varied. Oligonucleotides were obtained via solid-phase synthesis; purified using electrophoresis (PAGE); and characterized by mass spectrometry (MALDI-TOF). Circular dichroism (CD) was used to establish the structure and thermal stability of each hairpin. It was observed that the RNA hairpins folded into A- or Z-form depending on the sequence context. All DNA hairpins (synthesized in this work) folded into B-form; therefore, RNA sequence contexts were studied for their observed structure. Amongst the model strands, the 5'-GUA CGG AGG UAC-3' hairpin displayed consistent features to that of a Z-form duplex, and comparison to other RNA models (in this work) confirmed that both the stem and the loop are necessary to induce this structural arrangement. To corroborate this observation, 8-Oxoguanine (8-oxoG) was incorporated into the stem or the loop of the corresponding hairpin. 8-oxoG is known to exist in a conformational equilibrium around the glycosidic bond, thus making the region a useful probe for these types of change (associated with Z-form structure). The hairpins containing 8-oxoG within the stem, or the loop, were found to exist in the Z-form; thus, confirming the importance of conformational changes around the nucleobases. To better understand the structural features, two experiments are underway: a) NMR, and b) observe interactions between the hairpins and Z-RNA binding protein.
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The Association Between College Student's Levels of Stress and Time Spent in Nature - A Daily Diary Survey-
Zaira Villalobos, *Social Sciences & Humanities*
Mentor: Jonathan Shaffer

Abstract:
With the extensive growth of urbanization, many people across America have been forced to adapt their lifestyles to live in built environments. The rise of urbanization, especially in busy cities like Denver, can be linked to high levels of stress. College students in built environments may be at a higher risk of developing stress due to the difficulty in managing academics and managing urban-like environmental stressors. However, studies have suggested that exposure to nature can decrease levels of stress (Ewert & Chang, 2018). Therefore, this study aims to test how exposure to nature, for college students attending the University of Colorado Denver, may influence levels of stress. A daily diary survey was conducted in order to follow participants throughout their interactions with nature and their levels of stress after nature exposure. Stress as defined by Folkman & Lazarus (1984) was to be measured as how demanding a situation may be perceived by an individual and their perceived resources to cope with the stressful situation. This study was designed to look at one item that assessed demand and another item that assessed resources. Bivariate correlations were run in SPSS to examine associations between time/days spent in nature and the participant's stress levels.
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The Genomic Evolution of the SARS-CoV-2 Virus and its Effects

Kaelyn de Villiers, *Biomedical Sciences*
Mentor: Lori Twehues

Abstract:
Over time, the SARS-CoV-2 virus has evolved. This evolution has been influenced by both the selective pressure from the host's immune system, as well as the natural mutation rate of the virus itself. Tracking the genomic evolution of this virus and its strains, by observing changes at the amino acid and nucleotide level, will allow one to gain a better understanding of the potential impact specific mutations have had on the transmission of SARS-CoV-2. Data collected via sequencing a variety of protein sequences serve as the basis for not only understanding the function of specific proteins within the SARS-CoV-2 genome, but also what changes potentially contribute to the observable tradeoff between virulence and transmission. Out of 11 proteins that were sequenced, proteins ORF1a, ORF1ab, and the Surface Glycoprotein were found to have the highest frequency of mutations. Proteins ORF6, ORF7a, ORF7b, ORF8, and the Envelope Protein were found to have the highest conservation, and could potentially serve as targets for therapeutic intervention.
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The Modulation of Non-IgE Mediated Mast Cell Activation By Per- and Poly- Alkyl-Substances.

Courtney Moeder, *Biomedical Sciences*
Mentor: Jared Brown

Abstract:
Per- and poly-alkyl-substances (PFAS) are synthetic chemicals that are introduced to the environment by manufacturing companies. These chemicals persist in the environment for extremely long periods of time. Known as "forever chemicals," PFAS exposure renders the exposed to test positive for PFAS for their lifetime. Recent research suggests exposure to PFAS results in long term health effects, such as immune system suppression and lowered response to vaccinations. Since widespread usage of PFAS has been increasing yearly and with studies showing the adverse impact on health, a need for regulatory guidelines is now of major importance.
In this study, we look at how the varying types of PFAS effects mast cell degranulation rates. Concentration and length of treatment are also analyzed in its affects on the results. PFOA, PFAS, PFHS, PFBS and GENX, were used as treatment groups within this experiment. Rosa Mast cells were exposed to concentrations of the different types of PFAS at 1.0, 10. and 25. for 24 and 48 hr. time periods. The treated cells were then "activated" by exposure to a positive control of silver nanoparticles, known to cause activation by the MRGPRX2 receptor. β-Hexosaminidase levels were recorded and analyzed against the treatment group treated strictly with silver nanoparticles. Additionally, the results were compared to treatment groups at varying concentrations to identify if concentration had an impact on results. Furthermore, the results for the 24 and 48 hour time thresholds were compared against each other. The results suggest PFAS has an overall effect on mast cell degranulation. The results vary for each type of PFAS treatment. Certain PFAS, such as PFOA is seen to amplify activation. While certain PFAS, such as GENX is seen to repress activation.
Overall, varying the concentrations of PFAS didn't yield statistically different effects within the treatment groups. However, the time threshold of how long cells were treated for did impact the results obtained. Exposure at 24 hours yielded results that weren't statistically different then the 4880 control. This suggesting that longer periods of exposure cause a greater effect on mast cell activation.
In conclusion, PFAS exposure to mast cells has an impact on the rate of betahx release. PFAS was seen to either increase mast cell degranulation or suppress it, depending on the specific PFAS. While concentration wasn't seen to impact results, time period did.
The future direction of this study is to identify if PFAS has an effect on the glycolysis of the treated mast cell. As well as identifying if cytokine release occurs after mast cells undergo PFAS exposure.
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The Neurological and Cognitive Mechanisms Underlying Moral Decision Making
Zachariah Weir, Bradley Stewart*, Social Sciences & Humanities*
Mentor: Carly Leonard

Abstract:
The current analysis is an attempt to examine the processes that underlie moral decision making through a dual review of current cognitive and neuroscientific literature. The neurological perspective examines the brain regions and neural pathways associated with moral decision making. Cognitive processes that underlie our decisions come in a multitude of forms that evade our conscious awareness; it may be the amount of time allotted to us to make a decision, how the question was asked, or how the event was presented. A common denominator across the cognitive domain is that a change in how the same situation is represented can lead to moral inconsistencies. In most psychology research, there is not much overlap between these domains. The integration of these two perspectives may provide insight as to how neurobiological processes interact with unconscious cognitive processes based on environmental factors.
https://symposium.foragerone.com/2023-racas/presentations/56598

The QM/MM Simulations of the NarK Antiporter from *E.coli*
Natalie Schultz*, Natural & Physical Sciences*
Mentor: Hai Lin

Abstract:
Nitrogen is an essential element to life. Multiple forms of life necessitate the intake of nitrogenous compounds and export of nitrogenous metabolites for survival. Crucial to this function is the NarK protein, which transports the nitrate (NO3–) ion into the cell and the nitrite (NO2–) ion out of the cell.1, 2 Here, we report the preliminary data in our study of the prototypical NarK antiporter from E. coli with QM/MM model calculations. We aim to explore the quantum-level interactions between protein binding site residues with the ions as they travel through the pore. The results will inform future mutagenesis experiments.
https://symposium.foragerone.com/2023-racas/presentations/56658

The role of fatty acid oxidation and fatty acid synthesis on the metabolic preferences of CD8+ T cell response to subunit vaccines
Jordan Swartz*, Biomedical Sciences*
Mentor: Ross Kedl

Abstract:
Vaccines can protect us against pathogens by eliciting antibody producing B cells as well as CD8+ T cells. However, even today vaccines have trouble generating the magnitude and durability of CD8+ T cells which could add a powerful line of defense to help combat viruses and infections. CD8+ T cells divide at least 10-12 times during the early days of the response to either a vaccine or infection, experiencing a high metabolic demand to support this rapid proliferative burden. Prior data from our lab shows that infection-elicited CD8+ T cells prefer glycolysis while vaccine-elicited CD8+ T cells prefer fatty acid oxidation (FAO). In fact, vaccine-elicited CD8+ T cells perform both FOA and fatty acid synthesis (FAS), simultaneously breaking down and elongating lipids within the cell. The purpose of this research is to explore the functional consequences of metabolic preferences used by CD8+ T cells during a subunit vaccine response. Using flow cytometry, we isolate antigen-specific T cells and performed ex-vivo survival and proliferation assays to examine the reliance these cells have on FAO, FAS, glycolysis, and the pentose phosphate pathway. Preliminary results seem to suggest that vaccine-elicited CD8+ T cells have a dependence on the Pentose Phosphate Pathway to support their proliferation and expansion. This research helps bridge the gap in understanding what factors and pathways are uniquely critical for CD8+ T cells responding to adjuvant subunit vaccination, with the hope of incorporating metabolic targets as part of improving vaccine design.

https://symposium.foragerone.com/2023-racas/presentations/56574

The Role of Mitochondria Metabolism in CD8 Cell Mobility
Fahiima Abdullahi*, Biomedical Sciences*
Mentor: Mercedes Rincon

Abstract:
CD8 T cell migration is especially important because it allows for these cells to quickly migrate to tumors and kill tumor cells. In addition, once CD8 cells get into the tumor, CD8 cells also need motility (random walk) and fitness to be able to find their targets. When CD8 effector cells are expanded with Il-2 they proliferate and survive very well but have minimal capacity to move which can impact their anti-tumor immune responses. Our recent studies have revealed that effector CD8 cells expanded with IL-2 and IL-21, they display superior motility (faster and/or longer) than CD8 cells with only IL-2. We have obtained data showing that the effect of IL-21 on CD8 cell motility is by improving mitochondrial metabolism and mitochondrial Ca2+. Previous studies in our group have shown that MCJ is a negative regulator of mitochondrial respiration. We are currently investigating whether loss of MCJ also increases the migratory capacity and motility of CD8 cells by promoting mitochondrial respiration and improving fitness of CD8 cells. We propose that by enhancing CD8 cells motility we will be able to enhance their anti-tumor activity and killing of tumor cells.
https://symposium.foragerone.com/2023-racas/presentations/56652

The Significance of Pop Cultural Animation to Art History: An Analysis of *Avatar: The Last Airbender*
Megan Hassler*, Arts & Media*
Mentor: Maria Buszek

Abstract:
When analyzing the art historical canon, many will notice a distinct lack of familiar pop cultural works–without realizing the pop cultural works that are already included in the canon. If one looks carefully, the interplay of art and popular culture is evident as there is a reciprocal sharing of ideas and works across “high” and “low” arts. While some artists who have utilized techniques or icons from pop culture like Andy Warhol and Roy Lichtenstein are well-known, many pop cultural works are only added to the canon much later, or even completely overlooked. Animation as an artistic medium is pervasive through current pop culture and artistic teaching; however, there has yet to be a thorough exploration and discussion on its inclusion in the art historical canon. One such animated series that exemplifies the benefits of this inclusion is the animated television series *Avatar: The Last Airbender*. Not only does the series have strong artistic qualities, it also draws inspiration from the historical artworks from many different Asian countries, such as China, Japan, and India. Furthermore, this series epitomizes the transnational value that animation has, unlike many other art works currently included in the canon. Through an analysis of the artistic merit and art historical context used within the work, as well as the transnationalism of animation, in this presentation I will argue the value of including animation in the artistic canon should be self-evident.
https://symposium.foragerone.com/2023-racas/presentations/56538

The State of Black Maternal Health in Colorado
Mercy Kibet*, Social Sciences & Humanities*
Mentor: Hyeyoung Oh Nelson

Abstract:
In the United States, Black women/birthing individuals experience disproportionate maternal mortality rates. According to the Centers for Disease Control and Prevention (CDC), “In 2020, the maternal mortality rate for non-Hispanic Black women was 55.3 deaths per 100,000 live births, 2.9 times the rate for non-Hispanic White women” (2022). Moreover, “In Colorado, the preterm birth rate among Black women is 37% higher than the rate among all

other women" (MarchofDimes). This research proposal is driven by two broad research questions: (1) How does race and racism impact the maternal healthcare experiences of Black women/birthing individuals in Colorado? (2) How are maternal health care providers working specifically to improve the maternal health care experiences of Black women/birthing individuals in Colorado? To answer these questions, I plan to conduct 20 interviews: 10 interviews with Black women/birthing individuals and 10 interviews with care providers who support and care for Black women/birthing individuals during pregnancy, childbirth, and postpartum. Interviews with Black women/birthing individuals will focus on their general experiences receiving maternal health care in the US. Interviews with providers will ask about how they are working to alleviate the disparities that Black women/birthing individuals face in pregnancy, childbirth, and postpartum. This project seeks to affirm the experiences of Black women/birthing individuals in Colorado and to educate maternal health care providers in order to alleviate the disproportionate maternal mortality rates.
https://symposium.foragerone.com/2023-racas/presentations/56717

The Use of a 3D-Printed Model for the Interpretation of Chest CT Scans
Erika Alor*, Biomedical Sciences*
Mentor: Emily DeBoer

Abstract:
Three-dimensional (3D) printed models have served multiple purposes in many areas, such as academia and medicine. Its application has increased the performance of healthcare providers and students during medical simulations and procedures. Moreover, it has facilitated the visualization and comprehension of human anatomy compared to other tools available in two-dimensional (2D) or 3D virtual modalities. Therefore, a 3D-printed model of the thorax was created to determine its reliability in helping students and medical providers interpret the relationships between airways and blood vessels in chest CT scans. Physician Assistant (PA) students and pulmonary fellows participated in this study with an approved IRB protocol. A pre-test was provided to the participants a day before the scheduled meeting. On the day of the meeting, the participants used the 3D printed model along with a list of spatial relationships of the thorax, followed by a post-test. The average scores of five pulmonary fellows for the pre-test and post-test were 88% and 91%, respectively. Moreover, participants expressed feeling confident in identifying structures that surround the main bronchi after working with the 3D-printed model. Collecting and analyzing data from more participants will provide more insights to determine whether this 3D-printed model is useful when interpreting anatomical structures in cross-sectional views.
https://symposium.foragerone.com/2023-racas/presentations/56736

The Use of Fluorescent Fixable Dextran in Assessing Islet Vascular Permeability in Type 1 Diabetes.
Sarah Keller*, Tech, Engineering, & Math*
Mentor: Richard Benninger

Abstract:
Type 1 Diabetes (T1D) is a complex autoimmune disorder with a wide range of symptoms that can occur at any age. In many cases, autoimmunity begins years prior to symptom onset and substantial loss of insulin-producing cells has already occurred. Therefore, presymptomatic diagnosis is important for managing the disease and is currently done through islet-associated antibody tests. These tests can detect antibodies that suggest a risk of diabetes but cannot determine symptom onset or treatments efficacy. Prior work in our lab demonstrated that measuring increased permeability in blood vessels in the pancreas can detect T1D and better address the limitations of antibody tests. Vascular permeability can be measured using sub-micron sized ultrasound contrast agents, which have been shown to accumulate in and outside of islets with permeable vessels. However, this approach has yet to be validated against a gold standard for measuring vascular permeability. The permeability of the blood-brain barrier has been assessed by imaging fluorescent particles composed of a glucose polymer called dextran. I hypothesize that fluorescent dextrans can also be used to measure T1D-specific vascular permeability in mouse models of T1D. I tested this hypothesis by injecting 150kDa and 500kDa fluorescent dextrans and fluorescent lectin to label blood vessels intravenously in NOD (T1D) and SCID (control) mice. I quantified the results in fixed sections of the pancreas

by measuring fluorescent intensity of the dextrans in non-vessel regions of the islets. Preliminary data indicate that 150 kDa and 500 kDa dextrans are not effective at measuring T1D-specific islet vascular permeability when imaged 30 min. post injection. Going forward, I will assess if using different sizes or imaging at different times is more effective. Success in using dextran to assess islet vascular permeability may lead to more effective diagnostic techniques for T1D.
https://symposium.foragerone.com/2023-racas/presentations/56668

The Use of Honeybees (Apis mellifera) and Hive Products for Biomonitoring of Superfund Sites in Denver, CO, USA
Natasha Pember*, Natural & Physical Sciences*
Mentor: Christy Briles

Abstract:
European honeybees (Apis mellifera) and their hive products have been shown to be useful environment proxies. Globally, this managed species interacts closely with the environment while foraging on a variety of plant and water sources. As a result, the bees and their hive products contain pollutants found in the air, soil, and water within their foraging range. This poster presents the study design and background of our research that examines the bioavailability of environmental contaminants, particularly heavy metals and radioisotopes, on both active and remediated superfund sites in the Denver Metropolitan Area (DMA) using honeybees and hive products (e.g., pollen, honey and wax). Small colonies of honeybees known as nucleus hives (nucs) will be placed on or near five superfund sites across the DMA for eight weeks as well as on rural and suburban control sites without any known heavy metals or radioisotopes. Samples of bees, wax, pollen, and honey will be collected every two weeks during the peak resource period (June-July). Collected samples will be analyzed using an accessible, fast, and cost-effective method known as energy disperse x-ray fluorescence (ED-XRF) rather than the more widely used inductively coupled plasma (ICP) techniques that are expensive and require extensive sample preparation and specialized training to use. The proposed research is the first attempt at using honeybees for environmental sampling on superfund sites to determine environmental quality and contamination.
https://symposium.foragerone.com/2023-racas/presentations/56633

Their Space in Outer Space: Women and Star Trek Fanzines, 1967-1989
Meghann Brown*, Social Sciences & Humanities*
Mentor: Rachel Gross

Abstract:
The classic science fiction television show *Star Trek* has a reputation in American popular culture for having an extremely dedicated fanbase. Though science fiction fandom has long been regarded as a male space, the most prolific producers of transformative fanworks are and have been women. Following the show's 1966 debut, female fans produced the first *Star Trek* fanzine, or fan produced magazine, in 1967. In the years following, women in *Star Trek* fandom produced a massive body of transformative fanworks in the form of fanzines. These fanzines contained a wide variety of content, but the most common feature of *Star Trek* fanzines was fanfiction. This project explores the way women built their community and space in *Star Trek* fandom through the production and distribution of transformative fanworks in the pre-digital era.

While the field of fan studies is growing, much of the current research on the subject looks at fandom through a modern lens, focusing on fandom in the age of the internet. This project approaches the subject from a historical standpoint by chronicling the development of these female fandom spaces within the *Star Trek* fandom over the period between 1967 and 1989, prior to the widespread adoption of the internet. During this period, the production and distribution of these transformative works allowed women to safely challenge social norms through creative expression outside of the confines of their expected gender roles, as well as to build community and meaningful relationships through their shared love of *Star Trek*.
https://symposium.foragerone.com/2023-racas/presentations/56727

Transforming Healthcare in Post-Pandemic Recovery: Innovation in Process & Technology to Increase Patient Throughput while Reducing Clinician Burden and Addressing Health Disparities (One-4-All Initiative)

Marie Izere*, Biomedical Sciences*
Mentor: Jill Kaar

Abstract:
The COVID-19 pandemic has increased the burden of staffing shortages, rising costs, physical and mental decline of healthcare providers and the communities they serve, and widened gaps in care for racially and culturally minoritized and low-income patient families. To enable access to quality, patient-driven healthcare for all communities, we are partnering with Inside Out Medicine (IOM) to create a digital, self-service health app to provide patient families a clinical task list, streamline flow of care to prepare them for surgery, and make educational content and resources more easily accessible. Implementation of this individualized "boarding pass" is being piloted for families of pediatric patients undergoing gastrostomy (g-)tube placement. Through our collaboration, we have created three educational videos about 1) how g-tube placement surgery is performed, 2) how to perform a g-tube exchange, and 3) complications associated with g-tubes, all of which accommodate varying levels of reading and health literacy. Next, we are creating a modular patient care workflow within the app that can be assigned to families by clinical staff as indicated. Parent preoperative anxiety and satisfaction, provider burden, and volume of unplanned ED visits and calls to report g-tube concerns will be compared between families receiving standard of care and families receiving additional education through the IOM app. We hypothesize that implementing a digital workflow of clinical and educational tasks will increase throughput for patients, including minoritized, low-income, and low health literacy patients, and reduce administrative burdens on providers. We believe that providing families access to an individualized (based on medical and socio-economic needs) patient boarding pass experience and insight across all steps of care (clinic, preoperative, postoperative, at home care) allows clinicians to see where families struggle or succeed to result in more effective and equitable care, and empowers parents to take charge of their child's healthcare.
https://symposium.foragerone.com/2023-racas/presentations/56722

Understanding Perceived Safety in Denver's Transit System

Hildana Liben*, Social Sciences & Humanities*
Mentor: Carrie Makarewicz

Abstract:
The Crime Prevention Through Environmental Design (CPTED) provides principles for transit agencies to practice that cultivates an inviting and safe environment for riders. The policy handbook approved by the American Public Transportation Association (APTA) states US transit systems lack resources to maintain satisfactory security measures, CPTED overcomes these shortcomings through establishing "early" design and planning guidelines in attempt to reduce potential incidents. The objective is to conduct field research observing five Regional Transportation District (RTD) stations in low-income communities and five in upper-middle to higher-income communities located within the Denver Metro area to observe if CPTED guidelines are properly executed and interrogate if these guidelines remain adequate evaluations via a qualitive study managed by myself and a co-researcher. The research study's methods include (1) visiting RTD stations independently and filling out surveys assessing locations while recording observations and (2) revisiting these locations partnered with a co-researcher who will complete the same surveys and as well as record their personal observations. The purpose is to distinguish a difference in opinion or in my sense of safety with or without a partner. Conducting this research will provide RTD with the rider's perspective, especially from underreported groups which me and my co-researcher represent. RTD affirms on the official website their goal is to ensure the safety of their transit riders by stating, "the safety and security of our riders is a top priority. We have implemented several measures to improve your security while riding RTD." This system will be compared with the CPTED principles to answer the question on whether Denver transit riders are receiving equitable safety measures. This research will provide transit agencies a glimpse into the average transit

rider's experience and reveal inconstancies between the agency's service representation and rider's experience to properly evaluate and address the gap in transit experiences.
https://symposium.foragerone.com/2023-racas/presentations/56624

Visualization of Gene Expression in Eublepharis macularius Using In-Situ Hybridization
Madison Leeper, *Natural & Physical Sciences*
Mentor: Carlos Infante

Abstract:
There is a wide variety of limb lengths in squamate reptiles, including snakes and lizards. These vary in size due to different expressions of limb development genes as well as the presence of these limb development genes. This wide variety of limb development is the cause for our investigation of how limbs have been lost and regained in different group members. To aid our research, we used the Leopard Gecko, *Eublepharis macularius,* to be our model organism since this species is the most recent common ancestor of the squamate reptiles. To visualize gene expression for genes responsible for limb development, whole-mount in situ hybridizations were performed on varying stages of embryonic development in *E. macularius*. The in situ hybridizations will show where at a given stage a specific gene is being expressed. This is done by the preparation of a probe for a specific gene as well as a 4-day protocol of washes. The three genes that are focused on in this paper are Tbx4, Bmp4, and Pitx1. These three genes are found to be expressed at different stages in different degrees in different areas of the body. From the in situs, gene expression can be compared to other model species such as mice, *Mus musculus,* and chickens, *Gallus gallus domesticus*, in similar stages of embryonic development. This comparison can show how limb development gene expression can vary amongst model species as well as within squamate reptiles.
https://symposium.foragerone.com/2023-racas/presentations/56616

Vitamin Supplements Can Enhance Embryonic Stem Cell Pluripotency.
Farahnoz Sanginova, *Biomedical Sciences*
Mentor: Christopher Phiel

Abstract:
The vitamin supplement industry has grown to be worth 353$ billion USD in 2019 with 29,000 different dietary supplements being currently available to consumers (5).With an increasing number of these supplements being available to the public every year it is important to understand the ways in which they affect the human body. Unlike prescripIon medicaIons, vitamin supplements are not regulated. LiKle is known about how these supplements work. Previously it was shown that vitamin C enhanced embryonic stem cell funcIon but the exact mechanism remains unknown. We have introduced Reduced RNA methylaIon as a mechanism of enhancement of stem cell pluripotency. Therefore we asked whether Vitamin C was exerIng its effect through reducing RNA methylaIon. Vitamin C treatment alone had a small effect however combinaIon of vitamin C with a small molecule transferrin was shown to promote retenIon of pluripotency in mouse embryonic stem cells. Because vitamin C and a transferrin relaIve (lactoferrin) are both available over the counter we asked if those supplements combined enhance retenIon of pluripotency in mouse embryonic stem cells. We also tested a compound that is marketed as promoIng stem cell health. InvesIgated whether vitamin supplements such as Lactoferrin and stem cells combined with vitamin C enhanced stem cell funcIon.Embryonic stem cell colonies were treated with with different concentraIons of stem cells and lactoferrin with and without addiIon of vitaminC. This was done through RNA isolaIon and QuanItaIve Reversed Polymerase Chain ReacIon. This process allowed to measure gene expression. The findings suggest that vitamin supplement lactoferrin combined with vitamin C promote ESC pluripotency.
https://symposium.foragerone.com/2023-racas/presentations/56910

"Who Bears the Cost?": North Denver Environmental Justice Report & ArcGIS StoryMap
Ruth Mekonnen, *Social Sciences & Humanities*

Mentor: Katherine Dickson, PhD, MS

Abstract:
Achieving progress towards environmental justice relies on broad-based action and policy change. Colorado's North Denver communities have led the fight for these changes, calling attention to the disproportionate burden of environmental health impacts their communities have faced for decades and demanding accountability. The primary goal of "Who Bears the Cost?: The North Denver Environmental Justice Report & ArcGIS StoryMap", a collaboration between GreenLatinos, Colorado School of Public Health (CSPH), and other partners, was to obtain comprehensive data on the services and infrastructure that exist in the heavily-industrialized areas of Commerce City, Globeville, and Elyria-Swansea, as well as the environmental exposures that disproportionately impact the health and wellbeing of residents living nearby. This research summarizes key findings in the following areas: Land Use & Violations, Power Generation & Transportation Energy Production, Goods Production, Roads & Rail, and Waste Management.
These interconnected sectors exist in a relatively small geographic area and expose North Denver residents to significant environmental burdens, while the benefits of these sectors largely flow to surrounding Colorado communities. The report also highlights information gaps that prevent community members from knowing the true magnitude of impacts, particularly because, too often, information about sources of environmental pollution and impacts on community health is not collected, is collected in disjointed and siloed ways, and/or is held by private entities or research organizations but is not shared in a usable and transparent way with impacted community members. The findings of the report are presented through an interactive ArcGIS StoryMap, a visual "walk-through" that aligns with our vision to promote community advocacy and data justice through open, accessible, and collaborative environmental health data that is relevant and usable to both communities and policy-makers. Thus, we can bring public awareness and continue to promote policies that hold polluters accountable, which will, ultimately, protect the health of *all* communities.
https://symposium.foragerone.com/2023-racas/presentations/56860

Zoning & Housing Segregation in Denver: A Geospatial History
Amanda Rees*, Social Sciences & Humanities*
Mentor: Brian Page

Abstract:
Beginning in the early twentieth century, laws regulating and restricting the growth and development of American cities arose around the US. The publication of the Standard Zoning Enabling Act in 1922 allowed municipalities to define, separate, and assign land use categories to different parts of the city. Each zone - residential, business, commercial, and industrial - was to be located at particular places in the city and associated with specific building height and area restrictions, as well as limits on noise and vibration.

Denver started the process in 1923, and the City Council adopted the Building Zone Ordinance and Parkway Setback Regulations in 1925. While the initial goal was to separate residential areas from industry, whole communities were faced with the implications of suddenly residing in non-residentially zoned areas.

Where were these communities, and who lived there?

30 years later, the city had grown in both population and area. City officials created a new land use map and accompanying land use ordinance.

Were there areas that changed from residential to non-residential, and if so, who lived there?
Where did upzoning, or the increased density of housing, occur, and who lived there?

This project uses a temporal geospatial analysis of historical zoning maps, census data, and archival documents to understand how Denver's zoning codes -- versions published in 1925 and 1955 -- intersected with demographic segregation in Denver's neighborhoods, resulting in community displacement. Early zoning and planning processes have shaped the way Denver's population is distributed contemporarily. They helped to create segregation in housing patterns, socioeconomics, and demographics which may be related to disparities in education, income, healthcare,

among other social determinants of health. Recent conversations in the news related to land use planning and zoning have renewed public interest in the process, and by highlighting the issues created by zoning in the past, perhaps local and state officials can make more informed decisions moving forward.
https://symposium.foragerone.com/2023-racas/presentations/56588