WELCOME TO THE 2024 RESEARCH AND CREATIVE ACTIVITIES SYMPOSIUM (RACAS)!

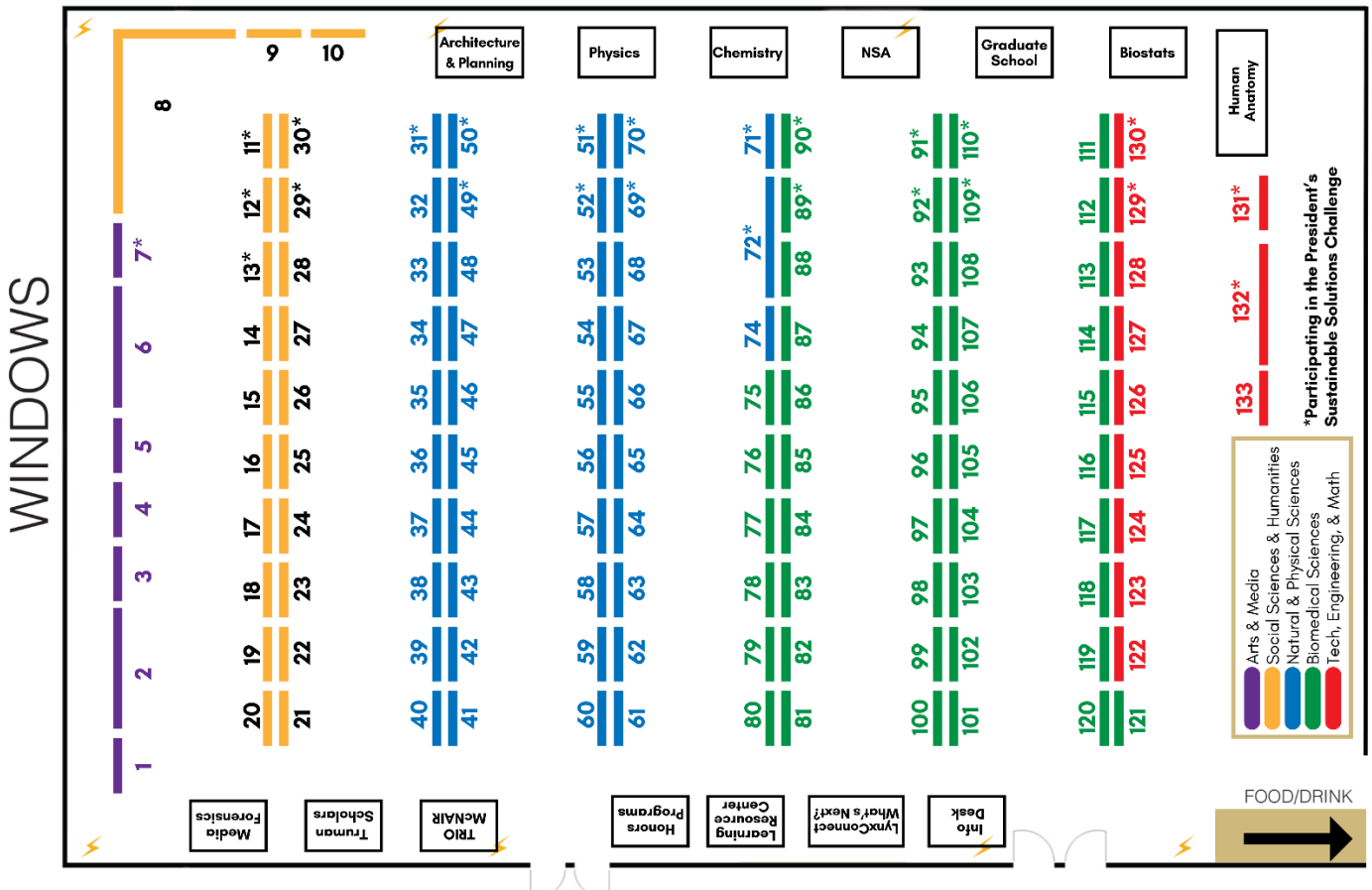
RaCAS is CU Denver's annual celebration of student-driven research, scholarship, and artistic endeavors. This year, we are thrilled to return to campus with a hybrid in-person event!
In the Virtual Project Showcase, you will find digital presentations showcasing the work of over 180 student presenters. 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
On Friday, April 26th, join us on campus or on Zoom to see many of these works presented live.

View All projects: https://symposium.foragerone.com/2024-racas/presentations

RACAS 2024 SCHEDULE

University of Colorado Denver

	Student Wellness Center Gym	Student Commons 1500	Student Commons 1600	Student Commons 2600	Student Commons 1401	Student Commons 2000	Student Commons 4125	Student Commons 4017
8:00 AM	*Exhibit Setup, Reviewer Check-in*	*Oral Presenter Setup*	*Oral Presenter Setup*	*Oral Presenter Setup*	*Oral Presenter Setup*	*Oral Presenter Setup*	*Oral Presenter Setup*	*Oral Presenter Setup*
9:00 AM	**Opening Remarks**							
9:45 AM	*Posters & Media Exhibits up for Viewing*	**President's Sustainable Solutions Challenge Oral Session 1** *Environment, Technology, & the Arts*	**President's Sustainable Solutions Challenge Oral Session 2** *Policy, Society, & Community*	**Arts, Social Sciences, & Humanities Oral Session 1**	**Arts, Social Sciences, & Humanities Oral Session 2**	**Arts, Social Sciences, & Humanities Oral Session 3**	**STEM Oral Session 1**	**STEM Oral Session 2**
11:30 AM	**Poster & Media Exhibit Presentations** **Lunch**	**Resource Fair**						
1:30 PM	**Closing Comments & Awards**							



RACAS 2024 AWARD WINNERS

PEOPLE'S CHOICE AWARDS BY CATEGORY:

- **Arts & Media** - **Josephine Clark** - Two is the Loneliest Number: Depictions of Friendship in Contemporary Western Art
- **Biomedical Sciences** - **Dien Thinh Nguyen** - Therapeutic Contact Lenses for Corneal Disease
- **Natural & Physical Sciences** - **Alyssa Cruz** - Inference of bacterial pathogen load in US rivers from landscape-scale shotgun metagenomic sequencing
- **Social Sciences & Humanities** - **Kenneth Huynh & Kim-Phung Van** - Beyond Inheritance: Healing Intergenerational Trauma with the WEALTH Program
- **Tech, Engineering, & Math -** **Brian Lim** - 3D Printed Continuous Fiber Reinforced Cellular Structures Material Properties

PRESIDENT'S SUSTAINABLE SOLUTIONS CHALLENGE AWARDS:

- **Policy, Society, & Community - Maleeha Shah - Maternal Mental Health: A Qualitative Interview Study of Maternal Health Providers in the United States**
- **Sustainability in our Environment & Technology - Stefanie Varghese, Ruth Hundie, & Luis Vargas - Exploring how the 2023 El Niño Evolved in Peru, Ecuador, the U.S. & Australia: Implications for Disaster Risk Reduction & Climate Justice**
- **Disparity/Parity in the Arts - Sam Hendrickson - Backstreet Bathory**

UNDERGRADUATE RESEARCH MENTOR OF THE YEAR WINNER:

- **Yang Wang, PhD** - Art History

UNDERGRADUATE RESEARCH MENTOR OF THE YEAR TOP NOMINATIONS:

- **Timberley Roane, PhD** – Integrative Biology
- **Kathryn Hamilton, PhD** - Physics

Thank you for joining us for the 27th Annual Research & Creative Activities Symposium!

1,4 Dioxane Fungal Degradation
Jaden Huynh, *Biomedical Sciences*
Mentor: Dr. Timberley Roane

Abstract:
The treatment of 1,4-dioxane, a potential carcinogen, is being successfully carried out at the Lowry Landfill Water Treatment Facility. Current research is identifying the 1,4-dioxane degrading bacteria involved in the Lowry bioreactors. However, there is limited research on fungal degradation of 1,4-dioxane, both at Lowry and in the literature, with only one identified isolate, Cordyceps sinensis, that was shown to degrade 1,4-dioxane. This study aims to identify potential fungal isolates capable of degrading 1,4-dioxane and to explain the conditions required for effective fungal degradation of 1,4-dioxane. Fungal isolates will be grown on solid agar media containing differing levels of 1,4-dioxane. Isolates will then be selected for growth studies where rates of 1,4-dioxane degradation will be measured. Those isolates capable of 1,4-dioxane degradation will be identified using DNA sequencing. This work has the potential to not only identify fungal species capable of degrading 1,4-dioxane for remediation purposes but will also contribute to our understanding of the metabolic pathways involved in fungal degradation of 1,4-dioxane. As a lesser studied group of microorganisms, fungi provide exciting opportunities in advancing environmental restoration.
https://symposium.foragerone.com/2024-racas/presentations/65420

3D Printed Continous Fiber Reinforced Cellular Structures Material Properties
Brian Lim, *Tech, Engineering, & Math*
Mentor: Guoying Dong

Abstract:
In the fields of aerospace and automotive, material property is a critical consideration for many applications where performance and weight need to meet a particular specification. Cellular structures and topology optimization is a tool that engineers are utilizing to fabricate lightweight parts with high stiffness-to-weight ratios. Many additive processes like fused fluid fabrication (FFF) 3D printing can produce these ultra-lightweight geometries, while traditional subtractive manufacturing processes cannot without taking a lot of time and money and wasting materials. It has also been known that adding continuous fibers to polymers can significantly enhance the material's stiffness without compromising the structure's weight. This project aims to determine the mechanical properties of 3D-printed continuous fiber-reinforced cellular structures (CFRCS). Many commercial continuous fiber 3D printers exist on the market, but their pre-processing algorithm significantly limits the freedom of fiber placement, and they are unable to fabricate these ultra-lightweight cellular structures. I have developed the first-of-its-kind G-code generation algorithm that can print CFRCS so that we can measure and improve the mechanical performance of CRFCS to facilitate the application of CFRCS in many engineering applications. I designed the toolpath for three different cell topologies (Hexagon, Quad, and Triangle), used my G-code algorithm to print CRFCS cellular structures, and tested their mechanical performance in compression tests against PETG samples. Initial findings were that PETG samples with the same geometries as our CFRCS outperformed our first generation of CFRCS samples and had strength-to-weight ratios 1.3-1.8 times larger than our CFRCS samples. Future work will focus on optimizing the G-code generation algorithm and toolpath to improve the mechanical performance of CFRCS. 3D printed CFRCS has the potential to produce ultra-lightweight high-performance parts, which helps products become more efficient and less wasteful.
https://symposium.foragerone.com/2024-racas/presentations/65471

3D printing of anatomical organ models for biomedical education: promises and pitfalls
Billy Lor, *Biomedical Sciences*
Mentor: Maureen Stabio

Abstract:
Three-dimensional (3D) printing is a fast-growing technology that has recently emerged into the field of biomedical education. 3D printed models are particularly valuable for teaching anatomy as organ replicas can be made at relatively low cost and high reproducibility. The goal of this project was to create a library of 3D printed models of human organs, to optimize the printing workflow, and to evaluate print results for educational utility. An Artec Space Spider 3D scanner and a photogrammetry app was used to digitally scan human bones and organs donated to the Modern Human Anatomy Program through the Colorado State Anatomical Board. Object files were edited in Maya and Zbrush software and converted to STL files for printing. An SLA resin printer with clear and white resin was used to print models of the human brain, vertebrae, and the cerebral arterial circle. An FDM printer was used with PLA and Nylon filament to create models of the cochlea, venous system, heart, and the cerebral arterial circle. Several of the prints were cast with silicone and then created with casting resin. The use of these 3D organ models were piloted in a graduate neuroanatomy course, as well as anatomy day camp for high school students at the CU Anschutz Medical Campus. Student perception of the models was positive and demonstrated that 3D printing can be incorporated effectively in an educational setting. Promises and pitfalls of the 3D printing workflow were reviewed. The promises included hands-on features, high verisimilitude, high reproducibility, and relatively low cost. The pitfalls included challenges with printing multiple colors, loss of detail, fragile nature of some of the filament models, and transparency. These promises and pitfalls can be used to help guide beginners in incorporating 3D printing into education and see the benefits and tradeoffs of using SLA vs FDM. Overall outcomes can easily be improved with more practice and training at all levels of the workflow. 3D printing is an exciting technology with great potential to be incorporated into all levels of biomedical education.
https://symposium.foragerone.com/2024-racas/presentations/65468

A Molecular Dynamic Simulation study of Lysosomal Membrane Protein Sialin
Eric Wooten, *Natural & Physical Sciences*
Mentor: Dr. Hai Lin

Abstract:
Sialic acids constitute a diverse array of compounds pivotal to numerous biological and physiological processes, including cell interaction, immune responses, and protein stability.[1] Their transportation across lysosomal membranes relies on sialin, a proton/sialic acid co-transport protein. Dysfunctions in sialin are associated with various diseases, such as Salla disease and infantile sialic acid storage disorder, which currently lack a cure. In this study, we conduct a molecular dynamics investigation into the transport mechanism of sialin, exploring protein conformational changes and emphasizing critical residue substrate interactions as n-acetylneuraminic acid traverses the pore.
https://symposium.foragerone.com/2024-racas/presentations/65427

A Preliminary Study of Attitudes and Beliefs of Physics in Non-Traditional Students
Shilene Davis, *Natural & Physical Sciences*
Mentor: Dr. Michael "Bodhi" Rogers

Abstract:
Non-traditional students are an underrepresented population in physics education research, especially around the attitudes and beliefs about learning and practicing physics. The University of Colorado Denver's Physics Department is made up of predominantly non-traditional students from a variety of backgrounds and offers the right population to begin to look into this. We will be giving the Colorado Learning Attitudes about Science Survey-Phys (CLASS-Phys) to our modern physics and quantum mechanics courses for the academic years of 2024-2025 and 2025-2026 to begin collecting data on the attitudes and beliefs that non-traditional

students have about physics. To gather this information, I will administer the CLASS at the beginning of the semester and again at the end of the semester to compare the pre- and post- data and track the progress and growth in the mindsets about physics. The expected data will show the increases in favorable ways of thinking about physics and a decrease in non-favorable ways of thinking about physics. The results will be used to begin to inform us on how non-traditional students interact with the physics community and be used as a preliminary basis for designing a study that goes further into the ways that non-traditional students view themselves as physicists.
https://symposium.foragerone.com/2024-racas/presentations/65727

Achieving musculoskeletal motor control using reinforcement learning
Elyas Larfi, *Tech, Engineering, & Math*
Mentor: Dr. Mazen Al Borno

Abstract:
In this research project, we aim to train a musculoskeletal arm model to reach a target using deep reinforcement learning methods. The complexity of this task is defined by the multi-dimensionality of human arm joints. We explore solutions for this task using a simulated environment called MuJoCo and a musculoskeletal model provided by Myosuite. The primary purpose of this research is to examine how task demands and noise impact the choice of muscle coordination pattern, and compare primate neural recordings performing the task to the produced artificial neural network activity.
https://symposium.foragerone.com/2024-racas/presentations/65488

Advancing Equity and Magnifying the Boundaries of Law and Society: *A Series of Interwoven Indigenous Justice Issues*
Hend Ahmed, Amy Wheeler, *Social Sciences & Humanities*
Mentor: Sheila Huss

Abstract:
This presentation contains five posters representing research carried out by five groups of students in a Master of Criminal Justice Law and Society class. It is based on a course project that was broken down into multiple parts, with each part reflecting an issue related to Indigenous justice. One consistent theme related to Indigenous justice suggests that existing policies, practices, and systems cannot be adapted to Indigenous communities. Injustices in Indigenous communities are rooted in colonialism and a lack of sovereignty. They are tied to intergenerational trauma; a lack of cultural awareness; and being stripped of their land and other resources, cultural practices, identities, networks, and ability to self-govern. The five topics provided an opportunity to research the problem, examine themes that emerged, and analyze implications for policies, practices, and future research. The topics are the Missing and Murdered Indigenous Women crisis; cultural competence and media representation; Native youth justice; Indigenous environmental justice; and historic racism, sovereignty, and boarding schools. Each group submitted a paper, a collage of images, an abstract, and a poster. Groups completed an experiential learning component, which could be a site visit, an interview, or anything that involved participation in a nonvirtual experience.
https://symposium.foragerone.com/2024-racas/presentations/65447

Advancing NMR-based Metabolomics through Computational Development
Abigail Chiu, *Biomedical Sciences*
Mentor: Dr. Woonghee Lee

Abstract:
Remember the last time you got your annual checkup? A nurse would draw your blood to assess any potential possibilities for diseases. Your blood can be used to study various diseases like breast cancer and prostate

cancer by seeing the different levels of small molecules in your blood. This type of study is called metabolomics. It uses the small molecules, also known as metabolites, that participate in different biochemical processes in an organism to understand the relationship between an organism's genetics and its environment. Metabolomics is applicable not only in diseases, but also drug design, nutrition, agriculture, renewable energy, and more. As the interest in metabolomics grow, meeting the demands of cutting-edge research requires tools that not only advance analytical capabilities, but also prioritize user-friendly features. So, my project encompasses the creation of two new cutting-edge tools, A-SIMA (Advanced-Software for Interactive Metabolite Analysis) and A-MAP (A Multivariate Analysis Program). In addition to my participation in the development of REDEN (Residual Decomposition of NMR Peaks), the entire computational methodology in NMR-based metabolomics can be effortlessly executed. With an easy-to-use graphical user interface, A-SIMA empowers users to perform metabolite identification on 1D and 2D NMR data effortlessly. A simple click of a button allows users gain complete control over their identification process via A-SIMA and multivariate statistical analysis via A-MAP using Principal Component Analysis (PCA) and Orthogonal Partial Least Squares-Discriminant Analysis (OPLS-DA) with regions of interests as inputs. The seamless integration of these programs provides scientists and professionals a comprehensive toolkit to not only expedite metabolite analysis, but to also navigate the complex relationship of biochemical processes underlying health and diseases. These programs are available for download at https://poky.clas.ucdenver.edu.
https://symposium.foragerone.com/2024-racas/presentations/65376

AHNA: Automated Homomer Structure by NMR and AlphaFold-Multimer
Karen Pham, *Natural & Physical Sciences*
Mentor: Dr. Woonghee Lee

Abstract:
NMR spectroscopy is a powerful technique for determining protein structures and dynamics, providing detailed information about their fold, orientation, and intermolecular interactions. NOESY (Nuclear Overhauser Effect Spectroscopy) determines these essential interactions. Advancements in protein structure determination have aided in determining larger and more complex proteins, including dynamic proteins. However, there are still challenges when calculating the structures of homodimer proteins, which are made up of two identical amino acid chains. Distinguishing the two amino acid chains is difficult due to their identical molecular weights, symmetry leading to the ambiguity of resonance structures, and the different conformations/shapes each chain can take. As a result, NOE signals tend to broaden and overlap more, leading to less accurate readings for distant restraints.
With AHNA (Automated Homomer Structure by NMR and AlphaFold-Multimer) these challenges are addressed for protein structure determination. The main objective of AHNA is to accurately determine the structure of homodimer protein given only the chemical shifts, NOESY data, and sequence of the monomer. AHNA is a software program that uses NOESY experimental data with the aid of Alphafold-Multimer to determine the intermolecular interactions between two identical homomers. By comparing intramolecular restraints calculated using POKY Builder Structure with multiple AlphaFold-Multimer structures, similar peaks can be identified and eliminated, allowing the distant intermolecular restraints to be revealed. AHNA is then run with XPLOR-NIH to simulate the annealing process and determine the homodimer structure within a few short clicks on Google Colaboratory Notebook.
https://symposium.foragerone.com/2024-racas/presentations/65390

An exploration of the representation of mixed college students at minority-serving institutions: Webpage exposure, present or non-existent
Celestine Swehla, *Social Sciences & Humanities*
Mentor: Dr. Jennifer Camacho Taylor

Abstract:
This presentation explores the inclusion and representation that higher education offers mixed individuals. An exploration of minority-serving institutions from the West coast is provided in this presentation. The intent of

this review was to explore the inclusion of the following terms on university web pages: mixed, multiracial, multiethnic, and/or biracial. Research (4, 5, & 8) shows that representation and a sense of belonging can be pivotal to the success of college students. This exploration can showcase to the higher education community the continued work necessary to dismantle harmful dominant conceptions of race.
https://symposium.foragerone.com/2024-racas/presentations/65318

Analog, a short film by the Student Filmmaking Club
Jose Trevino, Marley Tremmel, Jamie Chenhall, *Arts & Media*
Mentor: Sidney Reed

Abstract:
Two mainstream films stood out within the last 50 years as projects that pushed the boundaries of technological capabilities and influenced booms in the development and sophistication of Computer-Generated Images in cinema. Star Wars (1977), with the help of Industrial Lights and Magic, brought with it new ways of filmmaking seemingly impossible landscapes and action sequences with their introduction of motion control and some very early Computer-Generated Images. Fifteen years later, Jurassic Park (1993) and ILM broke new ground with innovatory approaches to 3-D modeling and texturing to create what audiences then thought to be the most realistic CGI in any film of its time. The directors behind these movies pushed the boundaries of technology in film, and yet George Lucas and Steven Spielberg pushed for a strong presence of practical effects whenever feasible. The team behind ANALOG sees practical effects as an art form that was seemingly losing ground as CGI achieved more and more, but with ILM's recent invention, the Volume, the mix of digital and practical effects is again at the forefront of the industry. We realize there are scarce opportunities to develop an understanding and proficiency with practical effects and how they serve the story being told in a film. So, we rallied around a story with a heavy necessity for practical effects. The monster in our film was designed and created by students and professionals in conjunction. All the effects were planned, risk-assessed, and executed by students with the guidance of our mentor Sidney Reed. The vision behind this project wasn't necessarily to create an exceptional film, but to create an exceptional educational experience for all the students involved to carry forward in future projects.
https://symposium.foragerone.com/2024-racas/presentations/65545

Artificial Intelligence (AI) Roadmap for the Construction Industry
Kevin Harris, *Tech, Engineering, & Math*
Mentor: Bing Han

Abstract:
This project will develop an artificial intelligence (AI) implementation roadmap tailored for construction contractors to adapt their business to this new technology. The AI roadmap will try to examine the issues faced by contractors and help provide them with practical solutions for how to deploy their resources in purchasing AI technology. The return on investment (ROI) of AI applications hinges on dynamic factors such as technology maturity, organizational preparedness, and risk management. Construction contractors will need a systematic evaluation of these factors to help them facilitate AI implementation.

This will be an industry-oriented guide that specifies organizational transformations and human resource allocations essential for AI deployment. Executives will find it invaluable for strategic company planning, while employees gain clear direction for professional development. I can foresee many benefits to the industry as well. Distributors and manufacturers will also benefit from insights into future market trends and technology needs, enabling them to tailor their products and services to meet evolving industry demands. Utilities can leverage the roadmap to anticipate and adapt to energy management and distribution changes driven by AI advancements. The possibilities for future research in a variety of areas is considerable.
https://symposium.foragerone.com/2024-racas/presentations/65226

Ascertainment of NarK Nitrate/Nitrite Antiporter's Mechanism Using Adaptive Partitioning Multilayer Dynamics Simulation

Faith Montemayor, *Natural & Physical Sciences*
Mentor: Hai Lin, Emilie Guidez

Abstract:
Biological processes rely heavily on the effective functioning of protein transporters facilitating the movement of substrates across membranes. Among these, the antiporter NarK plays a pivotal role in selectively transporting nitrate (a vital nitrogen-containing mineral) and nitrite (a metabolite prone to toxicity at high concentrations) across biological membranes in diverse organisms. Despite extensive biochemical investigations and crystal-structure determinations, the operational mechanisms of the NarK antiporter. A comprehensive understanding of these mechanisms necessitates a deep insight into the interactions between NarK's pore residues and the migrating ions.

For this, we plan to employ a multiscale approach to probe these interactions within NarK, integrating various levels of quantum mechanics (QM) and molecular mechanics (MM). Specifically, we are developing software for the application of novel interpolated adaptive-partitioning (IAP) multi-layer algorithms for conducting molecular dynamics (MD) simulations. These innovative methods will be implemented in the GAMESS-US and QMMM software, facilitating accurate and efficient MD simulations of NarK. This work will allow us to identify the pore residues that are crucial for the functioning of NarK and therefore propose transport mechanisms.
https://symposium.foragerone.com/2024-racas/presentations/65487

Assessing Craniofacial Prognathism in Plio-Pleistocene Hominins Using a Geometric Morphometric Approach

Jane Miller, Cheyenne McGregor, Chase Ochoa, *Natural & Physical Sciences*
Mentor: Dr. Charles Musiba

Abstract:
Facial prognathism in early humans and hominins is associated with dietary and musculature anatomy. The infraorbital foramen (INF), in which the infraorbital nerve innervates the facial muscles, is also associated with selective craniofacial modification in primates including midfacial prognathism. The placement and orientation of the infraorbital foramen can provide us with evidence related to Plio-Pleistocene dietary adaptation in hominoids. We hypothesize that the positioning of the infraorbital foramen in our human lineage correlates with the degree of facial prognathism, possibly indicating muscular configuration and dietary adaptation. We further hypothesize that midfacial prognathism is associated with dietary adaptive responses. In this work we theorize that the evolution of cranial facial morphology from midfacial prognathism to modern human flat face was associated with the ballooning of the skull and reduction of facial muscles in humans. Nine museum-quality skull casts (*A. africanus, P. aethiopicus, P. robustus, P. boisei, H. habilis, H. sapiens, H. naledi, H. rudolfensis,* and *H. georgicus*) housed in the Functional Morphology Lab and two *Pan troglodyte* and *Pan Paniscus* skulls from the Anthropology teaching lab were used to generate surface scans. Artec Space Spider scanner and proprietary Artec Studio 15 software were used to acquire 3D surface models for Geometric Morphometric landmark acquisition. We focused on facial prognathism areas and INF location on the maxillary bones. DHal (dHAL) Viewbox, and R software for 3D morphometrics were used to process 3D-surface scans where select landmark data was used in statistical analysis (including Principal Component Analysis). The Principal Component Analysis revealed some unique patterns where Paranthropus aethiopicus clustered with *Pan paniscus* and *Pan troglodytes* while *Paranthropus robustus* clustered with *Paranthropus boisei*. Furthermore, *Homo naledi* clustered with *Australopithecus africanus*.
https://symposium.foragerone.com/2024-racas/presentations/65513

Assessing the Effect of Environmental Safety on Criminality Judgments

Christiana Smith, *Social Sciences & Humanities*
Mentor: Dr. Carly Leonard

Abstract:
From a young age, we are taught the difference between things that are safe versus unsafe. We are told not to get into the car of a stranger and not to walk alone at night. Consistent with this lifetime of training, research has shown that certain qualities within a scene can increase or decrease people's likelihood of determining it is safe. However, there is little known about whether or not our safety judgments influence other aspects of our perception. In the perception literature, it is well known that many aspects of a scene can be processed with only brief exposure. Studies have shown that both conscious and unconscious judgments can impact other aspects of perception. However, it is not known if unconscious processing of perceived safety can influence judgments of criminality and recidivism. In the current study, we are proposing an experiment to answer whether using safe and unsafe scenes as a prime impacts how individuals rate people's likelihood to commit a crime. Preliminary analyses of 5 participants reveal unexpected trends with higher criminality ratings observed for white faces contrary to the original hypothesis.
https://symposium.foragerone.com/2024-racas/presentations/65549

Assessment of Liver Lipid Content in Fathead Minnows Exposed to Environmental Contaminants
Jason Lee, *Natural & Physical Sciences*
Mentor: Dr. Alan Vajda

Abstract:
Exposure of humans and other animals to per- and polyfluoroalkylated substances (PFAS) has been shown to adversely affect metabolic health and liver lipid metabolism.
This study examines the effects of exposure to groundwater contaminated by per- and polyfluoroalkylated substances (PFAS) on liver lipid content in fathead minnows, in order to gain a better understanding of PFAS effects on fish, people, and the environment. In 2018, 2019 and 2021, mobile laboratory experiments were conducted at a legacy fire-training area (FTA) where the groundwater had been contaminated by PFAS from fire fighting foams. Fish liver samples were analyzed for concentrations of cholesterol, triglycerides, phospholipids, free fatty acids, and total lipid content using commercially available kits. Preliminary data suggests that liver lipid content may be affected by exposure to FTA-contaminated groundwater. This research further reinforces the knowledge gap that is present in the field of endocrine-disrupting chemicals (EDCs) as well as establishes a basis for understanding of how PFAS, and other EDCs, may affect the human body. By utilizing lipidomics, a more comprehensive evaluation of liver lipid metabolic responses to PFAS mixtures can be achieved. Increased awareness of the occurrence and effects of PFAS, may promote the development of safer alternatives, proper disposal, and limit their non-essential use.
https://symposium.foragerone.com/2024-racas/presentations/65519

Association between Socioeconomic Status and Egalitarian Views
Maria Medina Hernandez, *Social Sciences & Humanities*
Mentor: Lizette Sanchez

Abstract:
Egalitarianism reflects the belief that the roles of women and men are equal (King & King, 1997). Both education and income are correlated with greater egalitarian attitudes (Bartlett et al., 2013; Chatard & Selimbegovic, 2007). In the current project, we aim to examine if the association between socioeconomic status (SES) and egalitarian views is moderated by gender. We hypothesize that women will have higher scores on egalitarianism than men and that SES will be positively associated with egalitarian views, with this association being stronger for women.

Data for the current project was collected in 2006 as part of a larger study of opposite-sex couples from the community. These participants reported on their annual income, educational background, lack of economic strain (i.e., a reverse score of how much difficulty they have had paying bills in the past 12 months), gender, and egalitarian views. Scores on income, education, and lack of economic strain were summed up so that

higher scores indicated higher SES. The Sex-Role Egalitarianism Scale (SRES, King & King, 1997) asked participants to rate questions on a scale from 1 = Strongly Disagree to 7 = Strongly Agree. An example item from this scale is “Women should worry less about their rights and more about becoming good wives and mothers.”

As hypothesized, results from a paired t-test identified that women had higher scores on egalitarianism than men (t = 3.21, p
https://symposium.foragerone.com/2024-racas/presentations/65475

Automation of Permuted-Adaptive Partitioning (PAP) Multilayer Dynamic Simulations
Anh Tran, *Natural & Physical Sciences*
Mentor: Hai Lin and Emilie Guidez

Abstract:
Computational modeling of large, diffuse biochemical systems (e.g., NarK nitrate/nitrite antiporter) can benefit pharmaceutical applications by revealing the chemical properties, reaction mechanisms, and conformational changes of drug candidates and target sites in a solvated setting. However, obtaining a high level of accuracy for large systems is currently unfeasible due to increased computational demands that rise with the number of solvent molecules in the system. Partitioning methods like PAP in the adaptive-partitioning multilayer (APML) method can build approximate models, which help reduce computational costs of solvation while maintaining quantitative accuracy. However, the current implementation of PAP is a time-consuming task that requires users to manually generate, submit, and analyze multiple files. Thus, our ongoing work includes automating PAP calculations to make the modeling of solvated biomolecular systems more feasible for all users.
https://symposium.foragerone.com/2024-racas/presentations/65543

Autonomous Electric Vehicle Navigation for Student guidance through Campus
Jesus Canales, Samuel Steen, Conner Beasley, Richard bergquist, *Tech, Engineering, & Math*
Mentor: Dr. Jaedo Park

Abstract:
The development of an autonomous navigation system using a modified electric vehicle (EV) prototype to guide students, including those with visual impairments, to multiple unknown locations on a university campus. The EV is equipped with a system that utilizes ROS 2 (Robot Operating System 2) to integrate data from a LiDAR sensor and multiple cameras for navigation, mapping, and localization, specifically employing Simultaneous Localization and Mapping (SLAM) techniques and Nav2 (Navigation2) for navigation.

The primary objective of this project is to provide a safe, efficient, and reliable means of transportation for students, ensuring accessibility to various campus locations independently. By leveraging advanced SLAM techniques and Nav2 navigation algorithms, the EV can autonomously navigate through indoor environments, detecting obstacles, and adapting its path accordingly.

Key features of the system include real-time SLAM-based localization and mapping, Nav2-based navigation planning and execution, obstacle detection and avoidance, and adaptive route planning algorithms. These capabilities enable the EV to dynamically adjust its route based on environmental conditions and user input, ensuring smooth and efficient navigation to desired destinations.

Further Improvements will include the implementation of machine learning algorithms for object detection, enabling the EV to identify and classify obstacles and navigate through complex environments more effectively. Additionally, real-time feedback mechanisms will be developed to provide the EV with decision-making capabilities based on environmental cues, enhancing its autonomy and responsiveness to changing conditions. The EV system has the potential to significantly enhance campus accessibility and inclusivity by providing students with an autonomous transportation solution tailored to their needs. Future research and

development efforts will focus on refining the system's capabilities, integration with campus infrastructure, and user testing to evaluate system performance and user satisfaction.
https://symposium.foragerone.com/2024-racas/presentations/65527

Backstreet Bathory
Sam Hendrickson, *Social Sciences & Humanities*
Mentor: Lacy Lowrey

Abstract:
This essay examines fandom from the point of view of disparate identities in fan culture. Using the fandom theoretical framework outlined by such authors as Duffet and Jenkins, this essay seeks to find similarities in fan communities that are stereotypically viewed as dichotomous. In addition to the theoretical groundwork, personal stories and anecdotes will be utilized to bridge the perceived gap between different fan communities. Both authors are long-time music fans themselves, one of heavy metal and one of boy band music. Their perspective from inside the community will be able to identify otherwise unknown behaviors and how they fit within the framework written by fandom scholars. The research revolves around three key stages of fandom; perception of fandom from outside the community, fandom as viewed from inside the community, and long-term fandom. Within these three main points of exploration, we will examine how identity and community evolve as one moves through the stages of fandom. The authors argue that within all the stages of fandom, there are more commonalities than differences in fan communities of heavy metal and boy band music.
https://symposium.foragerone.com/2024-racas/presentations/65341

Bacterial Bonanza: Analyzing the Distribution of Bacterial Communities in Lowry Water Treatment Plant Bioreactors
Victoria Crane, *Natural & Physical Sciences*
Mentor: Dr. Timberley Roane

Abstract:
The Lowry Landfill Superfund site, located in Arapahoe County, Colorado, is a regional landfill that accepted solid and industrial waste from the mid-1960s to 1980. Industrial waste, such as the potentially carcinogenic 1,4-dioxane, was found to have contaminated the surrounding soil and groundwater. In response, an onsite water treatment plant was installed to address the community's growing concerns.

As there are microorganisms within the water treatment plant reactors, naturally, plastic media are used to provide a surface for microbial biofilms to form, allowing researchers to conduct microbiological studies. Researchers gather specimens by sampling the plastic media and attempting to culture the organisms present while assuming that the microbial growth on the plastic media is uniform.

It is valuable to address the distribution and density of bacterial growth on these plastic media as they could have implications for past and future research endeavors since bacterial populations may differ on the plastic media's interior compared to its exterior. If there are inconsistencies in the distribution of bacteria over the plastic media's surface, significant errors could be introduced to studies about bacterial growth in the reactors. Additionally, the analysis and categorization of bacterial populations on the plastic media will contribute to our understanding of how bacteria degrade 1,4-dioxane, and other contaminants, in the water.

Using DNA extraction, DNA sequencing, and computational microbiological methods, this research will add to our understanding of the ability of microorganisms to degrade and remediate chemically impacted groundwater.
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Beyond Inheritance: Healing Intergenerational Trauma with the WEALTH Program
Kenneth Huynh, Kim-Phung Van, *Social Sciences & Humanities*
Mentor: Soyon Bueno

Abstract:
Background: Though historical trauma has a broad negative impact on the socioeconomic and psychological well-being of Vietnamese American communities, research remains scarce and deficit-focused. Mindfulness-based interventions have also been effective for healing forms of collective trauma but have had limited application in Vietnamese communities. To address both these research gaps, we developed, implemented, and evaluated a community-led mindfulness-based intervention that addresses historical trauma within the Vietnamese American community.
Methods: After months of community conversation, we developed a 4-week Wellness, Emotional Alignment, and inTergenerational Healing (WEALTH) program that includes psychoeducation about the intergenerational transmission of historical trauma, reflection activities, group dialogue, and mindfulness practice. Following IRB approval, WEALTH was piloted at CU Denver in Fall 2023 with a sample of 12 participants consisting of students and broader community members. Participants were eligible if they were 18 years or older, spoke English, identified as Vietnamese American, and had either immigrated to the U.S. or had a parent immigrate to the U.S. Data was collected via group audio recordings, post-program evaluation surveys, and individual interviews following program completion.
Results: Preliminary qualitative data analysis on interviews, audio recordings, and post-program evaluation surveys revealed that participants consistently reported a) greater understanding of intergenerational trauma and its impact on their daily lives and community, b) increased exploration of their identity in relation to Vietnamese culture and c) cultivated understanding of how intergenerational trauma's influence on their intimate and family relationships.
Discussion: Results overall suggest that WEALTH has a positive impact on several factors of individual and collective well-being, including sense of identity, family relationships, understanding of intergenerational trauma, and resilience in personal and family stories. The data confirms a need within the Vietnamese American community to promote community-based healing and the potential integration of mindfulness, given its intimate connection with Vietnamese culture and practices.
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BEYOND MICRODOSING MAGIC MUSHROOMS: ***How people of color and low-income individuals optimize mushrooms to cultivate wellness.***

Antonia Yanez, *Social Sciences & Humanities*
Mentor: Marty Otañez

Abstract:
My interest in the study lies mostly in the acute restructuralization of self-image and resistant thought patterns that mushrooms can offer to those seeking change that other therapeutic methods can't always offer, especially when utilized through the routine of microdosing. Several of the interviewees spoke about the benefits of microdosing as a way to bring clarity, relief, and significant change into their lives without having to commit more time and energy to a longer and more involved 'journey'. I am focusing on what has been mentioned by interviewees about microdosing from the frequency of usage, dosage, observed outcomes on mental health concerns, and overall perceived benefits. Several studies (Fadiman et al., 2019), (Kuypers 2020) have shown lower levels of anxiety and depression amongst "microdosers," in comparison to those who do not microdose. Additionally, researchers (Anderson et al. 2019) have seen benefits outside of mental health concerns, such as improved health habits, increases in energy, creativity, and work efficiency. Preliminary study results show that these benefits have been repeatedly confirmed. A general concern for those who haven't experienced mushrooms or a psychedelic trip seems to be that the hallucinations and journey experiences will be scary and too much to handle. It appears that microdosing is an effective way to approach psilocybin if the idea of a higher dosage mushroom journey seems too intimidating. While the experiences are different, many of the benefits are similar. My goal is to increase my skills to understand and promote knowledge of these benefits to educate the public and reduce psilocybin-related stigma.
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Biodegradation of Plastics by Pleurotus ostreatus
Amanda Castillo-Lopez, Caitlin Dong, *Natural & Physical Sciences*
Mentor: Ethan Dusto

Abstract:
Plastic pollution has become a significant issue due to the excessive usage and increased production of plastics. Microplastics from both conventional plastics and biodegradable plastics can have ecotoxic effects on organisms. Alternatively, in the biodegradation of plastics where fungi and bacteria are predominantly involved, fungi produce various enzymes that break down polymers into small monomers. The monomers can then pass through the microbial membranes and be used as carbon and energy sources. The biodegradation process can also create other byproducts more susceptible to natural degradation. White-rot fungi usually grow on wood, breaking down lignin in plant cell walls for nutrients from the plant. The fungi strains break down lignin with ligninolytic enzymatic systems, able to degrade a wide range of molecules. Evidence towards the direct involvement of white-rot fungi or lignin degraders in polyethylene (PE) degradation indicates the ability of white-rot fungi to degrade plastic polymers. Given the viability of using white-rot fungi to degrade plastics, Pleurotus ostreatus in particular, this study aimed to test how efficiently P. ostreatus can degrade plastics which are often landfilled because of difficulties in recycling them. P. ostreatus was grown on diapers, take out containers, and plastic grocery bags, which are slow-degrading plastics commonly found in landfills. We found that the mycelium may have had a significant impact on the tensile strength and strain of the plastics (particularly the plastic bag and diaper), however other material tests would need to be performed to confirm this finding.
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Black Maternal Health Experiences in the United States: A Qualitative Study
Mercy Kibet, *Social Sciences & Humanities*
Mentor: Dr. Edelina Burciaga, Dr. 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, the maternal mortality rate for non-Hispanic Black women was almost three times the rate for non-Hispanic White women. It is even more disheartening to think about how more than 80% of pregnancy-related deaths are preventable.These maternal mortality rates indicate that there are ongoing issues with maternal health in general. This research study was driven by the primary research question: (1) How do race and racism impact the maternal healthcare experiences of Black women/birthing individuals? To answer this question, I conducted 8 interviews: 5 interviews with Black women/birthing individuals and 3 interviews with Black doulas who support and care for Black women/birthing individuals during pregnancy, childbirth, and postpartum. I also work as a research assistant on a project that examines the broader landscape of maternal health and I was able to use data from previous interviews with both birthing individuals and doulas to help with my research question. Some themes that came up with birthing individuals include negative birthing experiences, different experiences and thoughts when it came to race, and difficulties in the postpartum period. Themes that came up with the doulas include providing holistic care, knowledge of systemic racism and its impact, burnout, and hierarchy and bureaucracy within the medical system. This project seeks to affirm the experiences of Black women/birthing individuals and amplify their experiences. Black women's voices are often not found in research, and their experiences largely go ignored. The study seeks to honor and provide the space for their voices to be heard. It also seeks to learn about the provider perspective of maternal health care providers to learn about the gaps and some of the hardships they face. The overarching goal is to help alleviate the disproportionate maternal mortality rates.
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Brexit and the Pavlovian Pathology: British National Identity 1793-1815
Aaron Heathcote, *Social Sciences & Humanities*
Mentor: Dr. Dale Stahl

Abstract:
The political arguments surrounding the Brexit referendum in the UK were ostensibly economic; Leavers contended that too much British money was being sent to the continent to the detriment of Britons themselves. The UK joined the European Economic Community (later the European Union) in the mid 1970's as a means of reviving a stagnant economy. Decades of economic and immigration shocks, fueled by the trend of globalization, motivated Britons to leave the single market and face the world on their own, a position with which they've been historically comfortable. Was Brexit, then, primarily motivated by economic factors, or were the social, political, and historical considerations the main engine for the Leave vote? This paper examines Brexit through the lens of the early 19th century, at a time when Britain's buccaneering spirit carried the nation to glory. Unions with both Scotland and Ireland, in which Britain's sovereignty expanded, brought together the British territory as a bastion of anti-continental spirit; the newly-integrated British military would forge nationalist bonds between soldiers as well as with future generations. Naval victories by eccentric commanders like Admiral Horatio Nelson would further entrench the maverick British disposition for the next two centuries. After exploring the pivotal years of 1793-1815, it is almost certain that modern economic concerns were not the sole or even primary motivation for the UK to leave the EU. Brexit, then, should not have been a surprise; Britain has always bucked the European continent. With such an independent national identity, it was perhaps joining the EEC in the first place that should have surprised us.
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Buddhism and Its Influence on Animation, Manga and Video Games
Makayla Oflynn, *Arts & Media*
Mentor: Yang Wang

Abstract:
In history, art was used for a variety of things ranging from recording history to spiritual practices in different civilizations. In Buddhism, artworks, like sculptures and paintings were used for visual stories and depictions of the Buddha. However, in recent times different mediums, like animation, cartoons, and manga have been using Buddhism along with other themes from Asia to make these works more appealing and entertaining to a wide audience around the world. Because most of these mediums are seen more as commercial products there is not that much research done on them as contemporary art pieces. For this thesis, these art mediums will be used to show how Buddhism is being used as an element of Orientalism to make them more appealing. This will be done by analyzing the history of these mediums, Buddhism, and some works from each of these perspective mediums even when the settings for them are fantasy-based. Some of these works come from different countries from around the world, but for this project, Japan, China, and the United States will be used. Not only will this thesis analyze how a character from these mediums incorporated Buddhism, but it will also analyze how the culture of these countries views Buddhism as a whole and how it influenced how Buddhism was incorporated. By using elements of Buddhism in these creations, mass media products like animation, video games, and manga create modern-day orientalism to market to a wide audience around the world. This thesis is going to be used to continue research of Buddhist art and orientalism by analyzing how cultures around the world adapt and change to keep these themes alive and not forgotten over time.
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Building a Raspberry Pi Cluster Computer to Understand High Performance Computing
Leah Piotrowski , *Natural & Physical Sciences, Tech, Engineering, & Math*
Mentor: Dr. Kathryn Hamilton

Abstract:
In the CU Denver Girls Who Code club, we focus on how to better assist our community as well as others when it comes to computational (computer) knowledge and resources. In doing this, we have started a project in which the goal is to learn and then teach the fundamentals of High Performance Computing (HPC), also known as parallel computing. What is parallel computing? And why is this important? Parallel computing is a form of

processing where we as users of this technology can run multiple tasks at the same time. This is important because we now can speed up our research so that calculations that once took weeks if not months to solve can now be done in only a few minutes. To do this, we are building a cluster computer by combining eight Raspberry Pi's, which are small single-board computers, into a custom-made acrylic case. We have obtained a construction guide as well as our other hardware to make this possible. Our team has finished designing the model for our case that will hold our Raspberry Pi's and have moved onto the construction side of this work. In time, we will be able to run our own calculations on our cluster as well as teach others how to use it.
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Business In Suits
Nicholas Hoffman, *Arts & Media*
Mentor: Eric Jewett

Abstract:
Business In Suits is a Senior Thesis production in CU Denver's Film and Television Department. The film follows a young woman named Knuma on the first day of her dream job, where she wears a suit that was haphazardly made from a cardboard box. Additionally, due to an unexpected need for the company to downsize, Knuma must compete to keep her new position against another new-hire.
This film is highly metaphorical in its imagery. Nobody ever addresses the cardboard suit, yet its presence is a constant reminder of our lead's mental state. Impostor Syndrome is an umbrella statement used to articulate perceptions of one's own skills and/or value that are lower than reality, resulting in feelings of separation and/or inferiority to one's peers. *Business In Suits* seeks to take this abstract concept and translate it into the Audio-Visual medium, so that it can be observed from a new perspective.
Almost everyone experiences Impostor Syndrome to some degree. It is as much a part of the human experience as love or grief, yet it goes largely unexplored in the world of filmmaking. With this movie, we hope to show that these kinds of stories can and should be told. Part of what makes Imposter Syndrome so powerful is that it can make you feel as though you're isolated from everyone around you. We seek to help kickstart a conversation about these issues. Even the realization that you're not alone in these feelings can go a long way in helping you overcome them. Beyond that, we hope to encourage people to be more aware of and empathetic to those around them, and remind them that there are people who genuinely want to see and help them become the best version of themselves.
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Characterization of Flow-Induced Vibration of Cylinders Via Wind Tunnel Experiments
Brian Can, *Tech, Engineering, & Math*
Mentor: Dr. Linyue Gao

Abstract:
Research on flow-induced vibration of cylinders is vital for structural integrity such as bridges and ocean rigs and increasing efficiency for energy-harvesting systems such as wind turbines. However, there are few studies on the behaviors of multiple cylinder arrangements with upstream solid bodies of irregular cross-sectional shapes. This study aims to observe the different vibration responses of a free downstream smooth cylinder with a fixed upstream iced cylinder versus a smooth cylinder and correlates them with varying inflow velocities and cylinder spacing. Using a wind tunnel, 3D-printed PLA cylinders, and sensors, the study investigates oscillation behavior with inflow velocities from 0 to 14.5 m/s. With the fixed smooth cylinder, the free smooth cylinder oscillated with increasing amplitude as inflow velocity increased for both 2.5D and 4D spacings. The fixed iced cylinder induced more horizontal oscillation at 2.5D while at 4D the oscillations were dominantly vertical. Both spacings for the fixed iced cylinder had amplitudes much lower than the fixed smooth cylinder.
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Cherry Baby
Lynden Joslin, Jamie Chenhall, Emily Carisch, *Arts & Media*
Mentor: Walter Chaw

Abstract:
This project allows students to explore intensive leadership roles within a filmmaking set. Our story, *Cherry Baby* follows a man and his relationship with himself and responsibility. The leadership of our team was made up of people taking on the roles of director, producer and cinematographer for the first time. The story drew inspiration from *Beau Is Afraid* by Ari Aster and *Badlands* by Terrance Malick. The cinematography drew inspiration from Jonathan Glazer's wide, voyeuristic films and Sam Raimi and Edgar Wright's kinetic movement and intentional composition. One of the biggest hurdles in producing this movie was finding a location that allowed filming and reflected the values of the story. This required a solitary and minimalistic environment. We were able to negotiate an ideal location with a homeowner in Alma, Colorado, where we had free reign to film interior and exterior scenes. We chose to shoot in a 2.39:1 aspect ratio, wider than typical films. This helped to further isolate the protagonist, and keep our audience in his mindset throughout the film. There are exactly two lines of dialogue, which gave our actor a particular challenge to portray deep character through movement. We also wanted to further juxtapose the lonely environment with Eli's relationship to responsibility.
The heart of this film arises from parental and societal pressures that most of our generation faces everyday. The world people are entering in America can be a fundamentally flawed system that gauges an individual's self worth on how well a person melds with old traditions and fixed perspectives of what success can mean at certain ages. Cherry Baby attempts to leave the audience with a sense of guilt and urgency when these pressures become crippling and show just how far a man will go to find approval.
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Chondroprotection in Murine Posttraumatic Osteoarthritis: Abaloparatide's Growing Efficacy Evidence
Rony Sawaqed, *Biomedical Sciences*
Mentor: Samantha Landgrave

Abstract:
Osteoarthritis (OA) is the predominant form of arthritis in the United States, characterized by irreversible articular cartilage loss in joints, leading to joint failure. Presently, there are no disease-modifying treatments available, with therapy primarily focused on pain relief and symptom management. In end stage OA, surgical total joint arthroplasty may be necessary. In OA, chondrocytes differentiate from the pre-proliferative state to hypertrophic until reaching apoptosis. Additionally, chondrocytes exhibit increased expression of the parathyroid hormone type 1 receptor (PTH1R), with previous studies showing activation of this receptor hinders chondrocyte hypertrophy and apoptosis while promoting cartilage matrix synthesis. Our study aimed to evaluate the effectiveness of PTH1R agonist, parathyroid hormone receptor-related protein (PTHrP or abaloparatide), in mitigating post-traumatic OA (PTOA) progression in murine models. This was done by surgically inducing PTOA in mice followed by abaloparatide treatment, we observed a deceleration in cartilage loss compared to controls. RNA sequencing revealed downregulation of pannexin 3 (Panx3), a gene with increased expression during chondrocyte differentiation, further supporting abaloparatide's chondroprotective role. Abaloparatide lowers Panx3 gene expression linked to chondrocyte hypertrophic differentiation. This indicates its potential to preserve cartilage integrity and serves as a targeted therapy for osteoarthritis by addressing disease-modifying needs. Expanding on these findings, in-vitro studies will give mechanistic insight to abaloparatide's chondroprotection seen in-vivo. We hypothesized that abaloparatide achieves its chondroprotective effects, in part, through Panx3 suppression. Using ATDC5 cells (chondroprogenitor cells) revealed abaloparatide's modulation of CREB-Panx3 signaling, enhancing chondroprotective gene expression while suppressing matrix-degrading pathways. These mechanistic insights further confirm abaloparatide's therapeutic potential in managing PTOA, offering a targeted treatment for this debilitating condition. The findings suggest that abaloparatide holds promise as a disease-modifying agent for OA, potentially addressing the unmet need for effective therapies targeting the underlying mechanisms of cartilage degradation.
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Comparing Terrestrial-based to Drone-based Laser Scanning for Historic Preservation
Daisy Wanless, *Natural & Physical Sciences, Tech, Engineering, & Math*
Mentor: Dr. Michael Rogers

Abstract:
This project details the historic preservation of the Heart Mountain Japanese American Internment Camp site near Cody, Wyoming. The 130-acre landscape containing standing historic architecture was documented using terrestrial and drone-based LiDAR. The terrestrial data were photo-textured and individual scans were registered together in post-acquisition processing. The drone uses high-precision GPS during flight to auto-register the individual scans together and the onboard camera automatically photo-textures the points, requiring minimal post-acquisition processing. The terrestrial laser scanner captured standing architecture with millimeter resolution, which is better than the centimeter resolution of the drone scanner. The terrestrial scanner's location close to the ground caused objects and vegetation to create gaps in the data regardless of the higher resolution. The drone-based laser scanner's location fifty meters above ground uniformly documented the landscape without gaps. Combining the two data sets creates a complete digital preservation of an evolving historic landscape.
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Comparison of Polycyclic Aromatic Hydrocarbon (PAH)-induced Gap Junctional Activity Changes in Mouse Lung Epithelial Cells
Ananya Alfred, *Biomedical Sciences*
Mentor: Alison Bauer

Abstract:
Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous in the indoor and outdoor air, such as particulate matter 2.5 (PM2.5) from wildfires, and are associated with reduced lung function, exacerbation of asthma, and lung cancer. Our previous research provided evidence that PAHs can inhibit gap junctional intercellular communication (GJIC), a major intercellular process important for cell-to-cell communication for cell signaling. Inhibition of gap junctions is a component of the "evading growth suppression" hallmark of cancer. Pyrene is a prevalent low molecular PAH used as a biomarker for PAH exposure in many epidemiological studies; pyrene can be converted to 1-nitropyrene by nitration, an event that can occur atmospherically to PM2.5, such as those particles found in wildfire smoke that are subject to long range air transport. In other model systems, 1-nitropyrene is known to be more toxic than pyrene. Therefore, we hypothesized that 1-nitropyrene elicits more adverse cellular effects to the lung epithelial cells than its parent compound, pyrene. We used a mouse alveolar type II cell line called C10 cells for these studies. Cytotoxicity assays were done using an MTS assay and GJIC was measured using the scalpel loaded/dye-transfer assay. For the cytotoxicity assays, we exposed cells for 24 and 48 h to doses ranging from 0-40 μM. For the GJIC assays, we exposed cells to PAH concentrations ranging from 0-20 μM for both pyrene and 1-nitropyrene for 4 and 24 hour time points. Cytotoxicity was observed in both pyrene and 1-nitropyrene, however, 1-nitropyrene was more toxic in the C10 cells. Similarly, we observed differences in GJIC inhibition. The concentrations eliciting GJIC inhibition were higher for pyrene than for 1-nitropyrene. These studies demonstrate the need for additional studies to compare 1-nitropyrene to pyrene and any differences in the downstream signaling events linked to GJIC inhibition, such as MAP kinases and inflammation.
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Compton Boosting in Blazars
Genevieve Bracher, *Natural & Physical Sciences*
Mentor: Dr. Masoud Asadi-Zeydabadi, Dr. Alberto Sadun

Abstract:
Blazars are quasars (supermassive black holes) in which the relativistic jet is aligned closely with our line of sight. Due to the orientation of their jets, they appear as a highly bright and variable source of radiation across the electromagnetic spectrum. These astronomical objects produce an emission line consisting of two distinct peaks. The first of these peaks is at low photon (primarily optical) energies and is attributed to synchrotron radiation. The second is at high photon (gamma-ray) energies and is attributed to the inverse Compton effect.

In our research this semester, we analyzed light curves of BL Lacertae--the first blazar to be discovered--in hopes of learning more about where and when these processes occur and if they occur simultaneously or concurrently. We concluded that they occur concurrently and what is likely at play is that the same electrons that produce synchrotron photons go on to Compton scatter them in a process called synchrotron self-Compton (SSC).
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Computational Analysis of a Neon Atom
Hamza Mekuria, *Natural & Physical Sciences*
Mentor: Dr. Kathryn R. Hamilton

Abstract:
Before 1925, physicists had very few methods that were useful in describing the world governed by particles, that is until the Time Dependent Schrödinger Equation (TDSE) was first proposed. This equation was so effective in predicting atomic behavior that this was considered a revolutionary point in time for the world of physics. One discipline of physics that benefited greatly from the inception of this equation is the field of Atomic, Molecular, and Optical (AMO) physics. Even though most problems in AMO physics can be explained through the application of the TDSE, it is impossible to solve this equation analytically for atoms bigger than Helium, and so numerical approaches must be used However, even with the application of contemporary computational methodology, there still exist areas in AMO physics where even conventional computers struggle to offer results on account of the massive amounts of data involved in a single calculation. Luckily, there are systems in the world that are capable of performing this computational feat, because they are equipped with massive amounts of computer cores, which grant them massive amounts of processing power. The intent of this research is to utilize the enhanced capabilities of high-performance computers in order to solve the TDSE of a Neon atom so that we can better understand the behavior of the electrons inside the atom. To do this, we will use a sector-leading atomic physics program called the R-Matrix with Time-dependence method (RMT). Specifically, we will try to calculate the amount of time it takes for an electron to escape from a Neon atom after the electron has absorbed a small packet of light called a photon. At the current stage of research further analysis is required before an accurate conclusion can be presented. However the study of light-atom interactions has the potential to impact many different fields of study, and future applications of this work could include establishing novel medical practices to improving the hardware of the very computers that have aided this research effort.
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Computational Component of Designing a Liquid 3He Detector
Isabella Adolf, *Natural & Physical Sciences*
Mentor: Anthony Villano

Abstract:
When designing a liquid helium-3 detector, we aim to create a more efficient helium scintillation detector for use in the Super Cryogenic Dark Matter Search (SuperCDMS). For this search, scientists are looking for low and rare energy events. By developing a liquid detector that can measure neutron backgrounds more accurately, the efficiency of detection will increase greatly compared to commonly used gaseous detectors. This process is more efficient because using a liquid compared to gas is more dense, which allows for better capturing methods. On the side of computational physics, I am using Python coding methods to project what certain

aspects and outcomes may look like from this liquid detector. This entails thinking about certain constraints and qualities of a detector that will affect its ability to take in information. This also includes thinking more theoretically about what the data will look like, how we can target specific data we need, and how the incoming information will be interpreted. This is a significant aspect of the project because it allows researchers to understand the detector's capabilities, and why it is important to build the detector a certain way for the most beneficial outcome.
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Computational Optimization of KIR Allele Inference
Heran Russom, *Biomedical Sciences*
Mentor: Paul Norman

Abstract:
Killer cell immunoglobulin-like receptors (KIR) modulate the activity of natural killer (NK) cells to protect the body against pathogens. Located in chromosome 19, the KIR complex's structural and genetic variability (including nucleotide polymorphisms and gene fusions) can predispose to several autoimmune and infectious diseases, presenting the challenge of effectively investigating this region. Our lab developed the stream-lined PING (Pushing Immunogenetics to the Next Generation) method to unveil the nuanced layers of this complex by aligning KIR short-read sequencing data to genotypically define KIR alleles. Here, we focused on KIR3DL3 and KIR3DL2 gene data, and the bioinformatic challenge was to optimize the allele assignation from PING results, given the complexity of the KIR region. To maintain high-quality variants, the pipeline focuses only on positions with a depth coverage greater than 20. Then, it converts the format of PING outputs to use them in PHASE, a statistical program that identifies haplotypes for a population, providing the maternal and paternal haplotypes for each individual. Lastly, the pipeline reorganizes the results to match the alleles for every possible haplotype. The outputs are then formatted to holistically present the alleles, the haplotype pairs, and their probability for each sample. This project's bioinformatic pipeline will be available to the scientific community and will adhere to the FAIR principles. This reproducible pipeline advanced the interpretability of the KIR investigation, improving our current understanding of this complex and facilitating the development of therapies that target the adverse effects associated with its variations.
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Could Digital Pills Improve Medication Adherence In Persons Living With Dementia? A Qualitative Study
Jonathan Gomez Picazo, *Biomedical Sciences*
Mentor: Dr. Elizabeth M. Goldberg

Abstract:
Nonadherence in older adults has led to adverse drug events (ADEs) simply because the patient could not remember or forgot if they had taken their medication. Nonadherence is more common in persons living with dementia. While digital advancements have increased, there is a need to integrate the opinions and preferences of persons living with dementia and their caregivers. Our objective was to interview patients with cognitive impairment or dementia and their caregivers to capture reactions to a new medication adherence technology, IDCap, which is an ingestible sensor that can notify patients and family members that a dose was missed.
Semi-structured interviews. We aimed to interview diverse older adults including different ages and ethnic backgrounds. Interviews were conducted in person, by video conference or over the phone. Framework analysis was used to summarize content into themes.
From March – June 2023 we interviewed 12 caregivers, and 7 care recipients. Of these, 16 (84.2%) were women, 2 were Black, 2 was Asian, and 1 was Hispanic. Interviews averaged 21.4 minutes. Care giver themes included: (1) traditional means of tracking medications adherence are still used (pill boxes, calendar, etc), (2) recognized the IDCap system has potential to increase medication adherence monitoring, (3) more information regarding safety of ingesting a digital pill is desired, (4) and the barriers of the IDCap system did not outweigh the benefits to initiate use. Care Recipient themes included: (1) no prior experience with medication

adherence tools, (2) comfortable with smartphone and do not mind receiving notifications reminding them to take their medications, (3) more evidence that IDCap system works, and the digital pill is safe to ingest, (4) and concern for design factors that would prevent them from wanting to use the IDCap system.
Interviews with caregivers and care recipients demonstrated potential for uptake of this new technology, however concerns surrounding safety, ease of use, and design factors still need to be addressed in clinical studies, ideally focusing on populations of older adults with cognitive impairment. Facilitators of use include clinician and family recommendations.
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Creating a Circuit to Measure the Impact of Chemical Pollutants on Electrogenic Bacteria
Anthony Janowsky, *Natural & Physical Sciences*
Mentor: Timberley Roane

Abstract:
In the modern age, there has been a dramatic uptick in chemical pollutants released into the environment. One of these chemicals, 1,4-dioxane, has come under scientific scrutiny due to its discovery in underground aquifers. 1,4-dioxane is a potentially carcinogenic compound that does not readily degrade in nature. The original objective of this project was to study the effects of 1,4-dioxane on electrogenic bacteria.

Electrogenic bacteria, such as *Shewanella oneidensis*, *Geobacter sulfurreducens*, and *Bacillus subtilis,* can generate an electrical output through a conductive biofilm that is secreted. Researchers are currently experimenting with using these microbes as a green-energy source. Understanding the effects of various chemical compounds on electrogenic bacteria will allow scientists to see if bacteria can continue to produce energy under chemically impacted conditions, such as with 1,4-dioxane.

When creating the experimental design, it was discovered that the available equipment did not have the sensitivity needed to measure the expected changes in the current output using the MudWatt system. The MudWatt is a simple microbial fuel cell that utilizes a 10μF capacitor that stores enough energy to power a light emitting diode in short bursts as a reflection of current. This rough estimation was not sensitive enough to measure any potential current changes introduced by chemical contamination. For the data to be accurate enough to calculate the current change, a circuit was designed to keep the voltage deflection at 1 Volt for 5 different current ranges from 1μA to 10mA (Amp range increasing by a factor of 10). The use of this circuit will allow for the accurate measurement of small changes in current output and will allow for the impact of chemical pollutants on electrogenic bacteria to be determined.
https://symposium.foragerone.com/2024-racas/presentations/65384

Design of a Liquid ^{3}He Neutron Detector
Tim Comstock, *Natural & Physical Sciences*
Mentor: Dr. Anthony Villano

Abstract:
This project aims to design a more efficient neutron detector for background characterization at SuperCDMS, an international collaboration project working on detecting theorized dark matter particles. Background radiation often enters the experiments sensitive instruments, registering false readings that are hard to account for without accurate background characterization. Many current neutron detectors detect radiation by reading electrical pulses created by ionization of a gaseous medium. While these types of detectors are very good at measuring certain types of radiation, they present two significant downsides for our application. Stray neutrons can contain a wide range of energies, and ionization detectors cannot measure these differences. In addition, gaseous mediums are not very dense compared to other states of matter. The lower the density, the lower the probability of these particle events occurring, leading to lower readings. This project addresses these concerns by measuring scintillations, emissions of photons from atoms that have been excited by incident radiation.

We are working to develop a scintillation detector using liquid helium-3 as a medium. Not only is helium in its liquid state ~64x denser than in gaseous form, but the (n,p) reaction the helium-3 nucleus undergoes when hit by a stray neutron allows for measurement of the incident neutrons energy level. The increased density of a liquid detector combined with scintillation readout should vastly improve detector efficiency, allowing scientists to determine background radiation levels much more accurately in sensitive environments such as SuperCDMS. This will increase the quality of data collected, greatly increasing the chances of detecting the theorized dark matter particles the collaboration is looking for.
https://symposium.foragerone.com/2024-racas/presentations/65451

Detection of 1,4-Dioxane and Tetrahydrofuran in Bacterial Degradation Studies using Gas Chromatography Mass Spectrometry
Jada Martinez, *Natural & Physical Sciences*
Mentor: Dr. Timberley Roane

Abstract:
While bacterial degradation studies of 1,4-dioxane and tetrahydrofuran-common groundwater contaminants-are being performed by microbiologists at the University of Colorado Denver, an analytical method for the quantification of 1,4-dioxane and tetrahydrofuran within bacterial growth media is unavailable. The work proposed here is the development of a 1,4-dioxane and tetrahydrofuran quantification assay using gas chromatography-mass spectrometry (GCMS). GC is an instrument used to separate and quantify compounds in a liquid sample. The compounds enter the MS as they are separated by the GC. In the MS, an energetic electron fragments the compounds in well-defined ways to allow for identification of smaller organic compounds. To ensure a quality analytical method, the generation of chemical standard curves has been the focus of the work. These calibration curves are critical to ensuring an analytical method's consistency. To do this, several conditions need to be optimized including the proper rate the temperature is ramped for the GCMS; manual versus auto sampling precision; and standard determination. Chemical complexation with medium components is an additional consideration. The development of the analytical method will help researchers confirm bacterial degradation of 1,4-dioxane and tetrahydrofuran in environmental remediation. This project shows the importance of learning common practices in analytical chemistry to understand how chemistry data is collected, analyzed, and ultimately used.
https://symposium.foragerone.com/2024-racas/presentations/65408

Detention Basin Systems: Mitigating Stormwater in Hampden Heights and its Implications on Cherry Creek Water Quality
Elizabeth Vossler, *Natural & Physical Sciences*
Mentor: Kayla Ahr

Abstract:
Sustainable urban planning is essential to the future of cities and the harmony of humans and the environment. Increased urban infrastructure creates more area of impermeable surfaces, leading to increased floods, runoff, and pollution in stormwater. Denver is currently developing bioretention and detention ponds across the city to mitigate this issue, and to make cities congruous with the natural landscape.
This project observes the water levels of a detention basin in Hampden, Colorado, that collects stormwater from a large portion of the neighborhood adjacent to Hampden Heights - where the research took place. The goal of the project is to investigate the efficacy of the anthropogenic system at filtering, absorbing, and draining stormwater from this area. The project will highlight the different levels of contaminants including nitrates, phosphates, and coliform bacteria, which will exhibit increased anthropogenic pollution in the water.
The research is expected to prove that these pollutants will have higher levels in the trash vault and bioretention pond, and the levels will decrease at the overflow pond and in the river to demonstrate accurate filtration of the pollution. However the data revealed that the anthropogenic pollution levels stayed fairly consistent throughout the entire system, which can be attributed to the collection of fine particulates in total suspended solids measurements, which create a cap on the bottom of the detention pond and limit the

infiltration of water. This project will contribute valuable insight on the further development of green infrastructure such as detention basins in Denver and across the world.
https://symposium.foragerone.com/2024-racas/presentations/63439

Determining the 3D structure of the hsACP-Zn-Ppant complex to advance the understanding of Fe-S cluster-related diseases.
Fatima Mustaffa, *Biomedical Sciences*
Mentor: Woonghee lee

Abstract:
Iron-sulfur (Fe-S) clusters are important for biological systems. They provide electron transfer, gene expression, and enzyme activity. They have a crucial role in the mitochondria where they act as mediators for electron transfer. Defects in Fe-S clusters can lead to cancer, metabolic, and hematological-related diseases that result in death. Fe-S clusters are generated by human acyl carrier protein compounded with zinc and phosphopantetheine (hsACP-Zn-Ppant) complex. To understand the role of hsACP-Zn-Ppant in the biosynthesis of the Fe-S cluster in the molecular level, we use nuclear magnetic resonance (NMR) spectroscopy to determine the three-dimensional (3D) structure of hsACP-Zn-Ppant. POKY was used to assign backbone and sidechain chemical shifts and determine the 3D structure of the holo-form of hsACP by our collaborators at the University of Wisconsin-Madison. We have taken over the project and worked on the 3D structure determination of the hsACP-Zn-Ppant complex with the collaborator at the National Cancer Institute (NCI). Generated distance restraints by POKY through the AUDANA algorithm have been carefully validated to achieve the goal. Upon the completion of the project, the hsACP-Zn-Ppant complex structure will provide valuable insights into the biosynthesis of Fe-S and pathways that regulate the expression or suppression of these clusters. Furthermore, it will provide crucial templates for the structure-based drug design (SBDD) that will help to find a cure for cancer, metabolic, and hematological-related diseases
https://symposium.foragerone.com/2024-racas/presentations/65481

Development of real-time PCR primers to analyze genes associated with degradation of 1,4-dioxane at the Lowry landfill
Jack Ratliff, *Biomedical Sciences*
Mentor: Dr. Timberley Roane

Abstract:
The Lowry Landfill Superfund Site (Aurora, Colorado) houses a series of bioreactors treating chemically impacted groundwater originating from buried waste material within the landfill. A chemical of concern is 1,4-dioxane, a solvent used in a variety of consumer products. In response to the potential human risk, the Lowry Water Treatment Facility is using naturally occurring microorganisms to degrade the 1,4-dioxane. While the importance of microorganisms in the removal of 1,4-dioxane from the contaminated groundwater is established in excess of 98 percent efficiency, the functioning of the microbial species along with genetic information about how 1,4-dioxane degradation needs to be further understood. This project aims to elucidate questions around the microbial involvement in the bioreactors using DNA-based multi-sequence alignment tools to identify microbial species as well as enzyme involvement in 1,4-dioxane degradation. The objective of the work presented here is to determine the presence of known enzymes associated with 1,4-dioxane degradation, such as methane, propane and tetrahydrofuran monooxygenases. To do this, DNA primers are being developed to detect and measure gene sequences similar to these known dioxane degradation genes. It is expected that the genes responsible for these enzymes will display different levels of gene expression when experimentally tested with real-time PCR, due to the different metabolic demands of each organism. Understanding which enzymes are involved will help identify and characterize the microorganisms involved in treating the groundwater at Lowry for longer-term optimization and sustainability of treatment.
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Dietary Sensing via Gustatory Pathway using EEG Wearable Device
Joseph Oler, Jordan Forestell, Luis Sandoval, *Tech, Engineering, & Math*
Mentor: Nam Bui

Abstract:
Accurate, real-time monitoring of dietary intake can allow primary care physicians to make recommendations to their patients quickly and effectively. Conventional dietary monitoring measures the chewing patterns of individuals via Inertial Measurement Unit (IMU), yet this method is subjective. Existing research has been able to differentiate salty and sweet tastes within participants using electroencephalogram (EEG) measurements and advanced signal processing techniques. Constraints of such monitoring include the bulky nature of equipment and financial barriers preventing access to preventative monitoring. In the pursuit of a user-friendly, generalized method of dietary monitoring, the primary aims of our project are to expand this research by utilizing our "behind-the-ear" EEG device, and to create a machine learning model used for reporting dietary information in real-time. We will record micro-voltage brain activity of 5 cardinal tastes detectable by the human tongue (salty, sweet, sour, bitter, pungent/spicy) via our behind-the-ear EEG. The preliminary data is 20 samples of brain data of each flavor for the three researchers involved. We've created water mixtures to test with, mixing salt into water for our "salty" flavor, sugar in water for our "sweet" flavor, etc. In each instance of data collection, there are six independent trials, five trials for each flavor and one plain water trial. For each trial, participants remain motionless while holding the mixture in their mouths for one minute. The gathered data will be split into training and testing data for machine learning with a k-fold validated classification model which is used to analyze the raw data. We expect this machine learning model to classify different flavors and make predictions in real time of what the user is eating. Our method of monitoring diet may prove to be a user friendly and reliable method for qualitative dietary analysis and may advance affordable access to health monitoring devices.
https://symposium.foragerone.com/2024-racas/presentations/65460

Disparities experienced by same-sex couples becoming parents
Michelle Le, *Social Sciences & Humanities*
Mentor: Krista Ranby

Abstract:
Disparities experienced by same-sex couples becoming parents
Michelle H. Le, Kelsey A. Nogg, Slaton Z. Freeman, Krista W. Ranby
Abstract
Background: The transition to parenthood (TTP) for many couples can result in health, behavioral, and relationship changes. However, there is limited research on how same-sex couples, who often experience minority stress, are impacted. This study aims to better understand the experiences of same-sex couples during the TTP through thematic analysis of semi-structured interviews.
Methods: Participants (N = 10 couples) were recruited through an online survey as part of a larger mixed-methods study. The semi-structured interview asked about topics related to couples' experiences during the transition to parenthood, such as health, stress, and relationship quality. The couples were interviewed for 30-90 minutes over Zoom. Some emerging themes were revealed in the sample's responses that will be supported by quotes.
Results: Most of the participants were female (respondents: 73%; partners: 77%), white (respondents: 71%; partners: 83%), young adults (respondents: Mean age = 28.48, SD = 6.56; partners: Mean age = 29.45, SD = 6.43) in same-sex relationships (90%). Interview responses revealed that there is a greater obstacle in obtaining IVF and insurance benefits for same-sex couples than for heterosexual couples. Some couples also had experiences with exclusive language and behavior in healthcare environments.
Discussion: The current findings reveal that a lack of inclusive language and behavior by healthcare providers can foster an unwelcoming atmosphere for LGBTQ+ couples and lead to oversights. Additionally, the requirement for multiple IUI attempts before receiving insurance coverage for IVF presents an added obstacle towards becoming parents. Future research might include further investigating the relationship between same-

sex couples' experiences with discrimination and stress during the TTP, or LGBTQ+ couples' experiences with discrimination and inequity in healthcare in different areas across the U.S.
https://symposium.foragerone.com/2024-racas/presentations/65507

Does the fungus *Suillus tomentosus* protect pines from lead (Pb) toxicity?
Will Leary, *Natural & Physical Sciences*
Mentor: Sara Branco

Abstract:
Soil metal contamination due to anthropogenic activity negatively impacts organisms. However, some species evolved tolerance and can persist in metal-contaminated sites. We recently found lead (Pb) tolerance in *Suillus tomentosus,* a mycorrhizal fungus commonly found in the American West that lives in mutualistic associations with pine trees. It is unclear whether and how *S. tomentosus* Pb tolerance impacts pine partner survival/health in Pb-contaminated environments. Here, we performed a bioassay study to investigate whether *S. tomentosus* protects pines from Pb toxicity. We inoculated *Pinus contorta* seedlings with Pb-sensitive and Pb-tolerant *S. tomentosus* and subjected them to a one-time Pb treatment. We hypothesized the Pb-tolerant *S. tomentosus* would allow for better seedling performance when exposed to Pb. We found no evidence that the Pb-tolerant *S. tomentosus* protected the pine from Pb stress. Seedlings inoculated with the Pb-sensitive *S. tomentosus* had higher shoot weight under Pb stress compared to control seedlings in the absence of Pb. Seedlings inoculated with both fungi had greater shoot weight compared to those with no inoculation and when not exposed to Pb, confirming the importance of mycorrhizal fungi. In order to confirm these results, future research should incorporate extended Pb stress and assess seedling growth over extended time periods.
https://symposium.foragerone.com/2024-racas/presentations/65430

Dorsal Vs. Volar wrist surgery technique by surface area visualization
Maximus Markgraf, *Natural & Physical Sciences*
Mentor: Michael Rogers

Abstract:
Effective surgical interventions for distal radius (DR) fractures demands a direct visualization of the fracture. This study sets to prove the efficacy of a direct visualization volar approach for wrist surgery. This is done by comparison of visible surface area to an established dorsal method.

Data collection from the cadaver arms encompassed articulated and disarticulated states for both approaches. Utilizing photogrammetry software, particularly Agisoft Metashape Pro (AGM), allowed for creations of scalable models. Photogrammetry software offers advantages over traditional methods like manual measurement in Photoshop, as it captures depth variations for accurate modeling.

Once data is imported into AGM, a four-step process creates detailed models, followed by scaling using AGM's scale bar functionality. Subsequent bone measurements are conducted by outlining the bone with multi-sided polygons, allowing for area analysis. Challenges arised in this process due to limitations in the data.

The results suggest significant differences in visible bone areas between the Volar and Dorsal approaches. The Volar approach consistently shows a lesser visible area compared to the Dorsal approach. This is inconclusive, however due to the drawbacks in the data. More research is needed which fixes these drawbacks.
https://symposium.foragerone.com/2024-racas/presentations/65506

Dynamic Light Scattering Methods for Carbon Nanotube Characterization
heather hassan, *Tech, Engineering, & Math*
Mentor: Dr. Randall Tagg

Abstract:
Carbon nanotubes(CNTs) have astounding properties at the nanoscale that differentiate themselves from other materials. These properties include superb flexibility and tensile strength, optical and thermal properties, and high aspect ratios. Due to their dual functionality as semiconductors and conductors, they have a wide array of applications in disciplines such as electronics, integrated circuits, and molecular sensitive sensors. Techniques for filtering CNTs are still costly and uncommon. To determine the most cost-effective way to separate single-walled carbon nanotubes (SWCNTs) into metallic and semiconductive forms for various applications, qualitative data about the size and composition of SWCNTs must be calculated to assess how this attribute affects the particle capacity of separation however, measuring particles on the nanoscale necessitates a high level of sensitivity with the instruments that are used for the size characterization. This Presentation will discuss how Dynamic Light Scattering can be used to assess the hydrodynamic diameter size of particles (d) on the nanoscale which is on the order of magnitude of 10^(−9) meters
https://symposium.foragerone.com/2024-racas/presentations/65553

Effect of Amniotic Fluid Extracellular Vesicles on Regenerative and Fibrotic Macrophage Phenotype
Tarren Stephens, *Biomedical Sciences*
Mentor: Dr. Jacot

Abstract:
Amniotic Fluid Derived Mesenchymal Stem Cells (AFSCs) exhibit certain regenerative properties for a range of cell types making them a focus for regenerative medicine. Extracellular vesicles (EVs) were identified as a functional component of the AFSC's regenerative properties. In this case, we evaluate the potential of AFSC EVs to improve clinical outcomes of neonates with congenital heart defects. This experiment focuses on how AFSC EVs affect monocyte derived macrophage phenotypes to better determine the potential of AFSC EVs in regenerative therapies. Macrophages were selected as a model cell type in evaluating the regenerative potential of AFSC EVs due to their significance in congenital heart defect pathology as they assume regenerative or fibrotic phenotypes. Here, we cultured and stimulated AFSCs to produce EVs, which were subsequently purified and delivered to monocyte derived macrophages *in-vitro* under varying experimental conditions to determine if AFSC EVs influence the propensity of macrophages to display an inflammatory or regenerative phenotype. Additionally, we evaluate if AFSC EVs can induce a more regenerative phenotype in fibrotic macrophages that were previously exposed to lipopolysaccharide. The results will better characterize the potential of AFSC EVs in regenerative therapies for neonates with congenital heart defects.
https://symposium.foragerone.com/2024-racas/presentations/65733

Efficacy of PARP inhibitor Talazoparib on Invasive Lobular Carcinoma breast cancer models
Jordan Swartz, *Biomedical Sciences*
Mentor: Matthew Sikora

Abstract:
Background: Anti-estrogens are a cornerstone of treatment for invasive lobular carcinoma (ILC) as nearly all ILC express estrogen receptor α (ER). However, anti-estrogen resistance remains a pervasive clinical problem. We previously linked ER activity and anti-estrogen resistance in ILC to ILC-specific activity of MDC1 (mediator of DNA damage checkpoint 1) as an ER co-regulator. We subsequently found that in ILC cells, canonical MDC1 functions in DNA repair may be compromised, manifesting as dysfunctional DNA double-strand break repair. ILC cells may be sensitive to PARP inhibitors (PARPi) as a mechanism to exploit this DNA repair dysfunction. Methods: ILC cell lines MDA-MB-134VI (MM134) and SUM44PE (44PE), and IDC cell lines MCF7 and T47D, were treated with FDA-approved PARPi talazoparib and/or anti-estrogens tamoxifen or fulvestrant. Aromatase inhibitors were modeled in ILC lines through short-term hormone-deprivation for 72 hours, followed by PARPi

treatment. Proliferation and long-term survival was assessed by dsDNA quantification. Talazoparib response was examined in long-term estrogen-deprived (LTED) anti-estrogen resistant variants of MM134 and 44PE. Results: ILC cells were sensitive to single-agent talazoparib (IC50 = 38nM and 13nM in MM134 and 44PE, respectively), showing compromised long-term viability after drug wash-out. In contrast, T47D IDC cells were talazoparib-resistant (IC50 = 140nM); MCF7 showed initial sensitivity (IC50 = 20nM) but proliferated normally after drug wash-out. Combining anti-estrogens with talazoparib did not reduce ILC cell sensitivity to talazoparib, suggesting PARPi sensitivity in these cells is not explicitly linked to proliferation. LTED variants of 44PE and MM134 were sensitive and resistant to talazoparib, respectively, associated with differential activity of ER and MDC1 in these models.
Conclusions: ILC cells are sensitive to PARP inhibition with talazoparib, potentially associated with an unappreciated DNA repair deficiency. Developing biomarkers of ER, MDC1, and DNA repair activity in ILC is critical toward understanding PARPi sensitivity in primary versus anti-estrogen resistant ILC.
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Engineering 3D Lung Models with Magnetically Labeled Fibroblasts
Dema Essmaeil, *Biomedical Sciences*
Mentor: Chelsea Magin

Abstract:
Idiopathic pulmonary fibrosis (IPF) is a chronic disease that progressively affects the lung, leading to respiratory failure. The extracellular matrix (ECM), the proteins and other molecules supporting the cells in our tissues, plays an important role in lung development, repair, and disease. Biophysical and biochemical signals produced by the ECM regulate the function of various cells including fibroblasts in the lungs. Fibroblasts are important lung structural cells providing production and repair of the ECM. There is an increased ECM deposition during IPF that results in increased tissue stiffness and a positive feedback loop of fibroblast activation. The Magin lab has advanced technologies for engineering models of lung tissue and created hybrid-hydrogels to mimic, decouple, and study biochemical and biophysical changes in the cellular microenvironments. In my project, I decellularized human lung from healthy and fibrotic donors and incorporated the resulting proteins and other molecules into 3D hybrid hydrogel models. In these models, we recreated lung geometry by magentically aggregating a layer of fibroblasts around stem cell-derived epithelial cell spheroids. We confirmed the decellularizaion process by analyzing the residual DNA that was below 50 ng/mg in both healthy and fibrotic samples. We selected fibroblast densities and aggregation time to create the structure that best replicates distal lung architecture. By embedding these structures in hybrid-hydrogels containing either healthy or fibrotic dECM, we will investigate the role of both cellular and extracellular components in the progression of IPF. This model will allow for patient-centered research by using human cells and dECM to study fibrotic phenotypes in a system that mimics the geometry, composition, and biomechanical properties of lung tissue.
https://symposium.foragerone.com/2024-racas/presentations/65552

Enhanced VMD Plugin for QM/MM Input Preparation
Faith Montemayor, Sam Fredrick, Muhamadjon Dzhalolov, *Natural & Physical Sciences*
Mentor: Hai Lin

Abstract:
The manual preparation of input files for QM/MM molecular modeling poses a significant challenge due to its time-consuming and error-prone nature. Our project addresses this challenge through the translation of the POKY QMMM plugin, built originally for the PyMOL program within the POKY suite, to Visual Molecular Dynamics (VMD), a widely used molecular visualization program. This translation aims to automate the preparation of QMMM input files in VMD, thereby reducing workload and minimizing errors associated with identifying QM atoms and cap atoms.
Our approach involves revising the existing POKY plugin to incorporate VMD functionality. This includes an interactive selection of QM and cap atoms, parsing QMMM input files, displaying relevant atoms during

visualization, and writing their serial numbers to a text file. The translated plugin significantly streamlines the QM/MM input file preparation process within VMD, providing users with a more efficient and accurate means of preparing input files for molecular dynamics simulations.
The significance of our work lies in its direct impact on the QM/MM community using VMD. Automating input file preparation will benefit researchers by saving time, improving data accuracy, and enhancing the reproducibility of scientific research. Furthermore, the integration of the POKY functionality into VMD expands the software's capabilities and accessibility for advanced molecular modeling techniques.
Overall, our project contributes to the ongoing progress and adoption of QM/MM modeling in VMD by providing a seamless translation of the existing POKY plugin. This advancement fosters collaboration and the sharing of knowledge within the scientific community, promoting the accessibility and standardization of tools for molecular dynamics simulations.
https://symposium.foragerone.com/2024-racas/presentations/65484

Enhancing Cardiac Spheroid Contractile Performance with a Gold Nanoparticle-Functionalized Conductive Reverse Thermal Gel
Maria Orlandi, *Biomedical Sciences*
Mentor: Brisa Pena

Abstract:
The development of a mature *in vitro* cardiac tissue involves the design of a scaffold supporting a proper electrical communication, mechanosensing, and mechanotransduction of cardiac cells, known for their electroactive nature. Moreover, creating a three-dimensional (3D) environment is essential to mimic native tissue structure effectively. Cardiac spheroids are simple, yet effective 3D structures made of cardiomyocyte and cardiac fibroblast that spontaneously aggregate to form a spheroidal body. In this work, we demonstrate the enhancement of contractile properties of cardiac spheroids composed of neonatal rat ventricular cardiomyocytes (NRVMs) and neonatal rat ventricular fibroblast (NRVFs) by culturing them in 3D for up to three weeks using a conductive reverse thermal gel (RTG) functionalized with gold nanoparticles (RTG-Au). The RTG-Au transitions from a solution at room temperature to a three-dimensional (3D) gel-based matrix shortly after reaching body temperature, allowing for 3D cell culture. Cardiac spheroids grown in these nano-engineered hydrogel exhibited signs of advanced maturation, including increased gap junction expression, improved beating synchronicity, and enhanced twitch power, particularly after undergoing mechanical loading.
This study highlights the crucial interplay between electrical and mechanical cues in driving the development of a mature, adult-like cardiomyocyte phenotype. Consequently, it lays the foundation for the development of novel strategies aimed at creating physiologically relevant *in vitro* models for various tissue engineering applications.
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Examining the Effects of Health Vulnerability on Aggravated Assault with a Firearm: An Equity Application
Courtney Leapley, *Social Sciences & Humanities*
Mentor: Sheila Huss

Abstract:
Due to an overall increase in aggravated assault, Governor Jared Polis has appointed a Crime Prevention Working Group (CPWG) to create solutions in an effort to make Colorado a Top 10 Safest State. CPWG has stated they will reduce the rate of aggravated assaults by 6% by June 30, 2024. The short timeframe for CPWG to enact these solutions suggests a “band-aid” approach rather than a deeper look at the systemic and structural racism, health disparity, and social disorganization mechanisms behind aggravated assault rates. Notably, health should not be narrowly contextualized as medical outcomes but rather considered in the broader framework of social determinants of health, such as poverty, racial disparity in health equity, residential segregation, neighborhood disorganization, access to health insurance, and medical and behavioral resources. In this proposed project, a health equity framework will be employed to study aggravated assault with firearms, including domestic violence assaults and assaults against law enforcement officers,

both of which increased substantially over the past three years. We need to understand the inequities that lead to crimes, violence, and other adverse outcomes in order to establish meaningful and sustainable policies that will make Colorado a safer state, in this case by reducing the number of aggravated assaults enacted with a firearm.
https://symposium.foragerone.com/2024-racas/presentations/65478

Exercise, Stress-Resistance and the NAc-DRN Pathway in Female Rats
Sachiel Oberto, *Biomedical Sciences*
Mentor: Dr. Benjamin Greenwood

Abstract:
Stress-related psychiatric conditions represent a large economic burden due to disease and are more common in women than men. Physical activity reduces symptoms of stress-related psychiatric conditions in both sexes by protecting the brain from stress (e.g., stress-resistance). Exercise is naturally rewarding to both sexes, and the rewarding effects are assumed to contribute to stress resistance from exercise, which is more robust in female rats versus males. Exercise limits release of neurotransmitters in brain regions related to the stress response, but whether the rewarding effects are related to this adaptive stress response remains unknown. Our research aims to investigate the connection between reward-related and stress-related brain regions, and how this connection is involved in stress-resistance from exercise in females.

By injecting different viruses into our target brain regions, the connection between the reward and stress-related regions can be “turned off.” We hypothesized that upon turning the connection off during stress, anxiety-like behaviors would return in exercised rats. Preliminary results analyzed with a multifactorial ANOVA indicate that this is indeed the case. If confirmed in additional animals, the results have the potential to reveal a novel stress resistance connection between reward and stress-related regions, and could improve understanding of treatments for stress-related psychiatric conditions.
https://symposium.foragerone.com/2024-racas/presentations/65381

Exploration of Alternative Noninvasive Therapy for Parkinson’s Disease
Blanca Duenas-Huizar, *Biomedical Sciences*
Mentor: Mazen Al Borno

Abstract:
Parkinson's is a degenerative disease that impacts the nervous system. It targets the midbrain, harming the substantial nigra; after the damage, the patient could experience bradykinesia (slower movements than usual), tremors (involuntary body movements), and loss of smell. Parkinson's has no known preventative solutions due to its inconclusive cause; the enigma drives us to explore an alternative treatment that may relieve symptoms. Currently, two common approaches to treating Parkinson's Disease are Levodopa and brain stimulator implantation surgery. Levodopa converts into dopamine, which improves the motor symptoms that Parkinson's patients experience, but it also has long-term effects, for example, negative cognitive effects (hallucinations and change of mood), dyskinesias, and unpredictable body movements. Patients who do not tolerate medication could opt for brain stimulation surgery; after the procedure, patients can experience motor improvements. On the other hand, side effects of brain stimulation include negative impacts on other areas of the brain, leading to motor control problems. Vibrotactile stimulation is a noninvasive therapy that works by stimulating the patient's fingertips; because the therapy does not involve medication or surgery, it is expected to have minimal side effects. Vibrotactile therapy has shown promising results in a single pilot study. Although the pilot demonstrated a reduction of motor symptoms, the study did not record the reduction of local field potential (LFP) power in the midbrain, which is essential to evaluate the effectiveness of the treatment. So, we sought to replicate and expand on previous findings by developing a therapeutic device, administering vibrotactile therapy, and measuring the effect on brain activity by recording LFP during the therapeutic trial. We successfully performed a pilot with a single patient and observed a marked decrease in LFP power during the

therapy, suggesting that the therapy works by altering activity in brain regions impacted by Parkinson's Disease.
https://symposium.foragerone.com/2024-racas/presentations/65336

Exploring Cardiomyopathy Among African Americans: An Analysis of Age, Sex and Disease Type
Grace Spillers, *Biomedical Sciences*
Mentor: Brisa Pena

Abstract:
Heart failure contributes significantly to the global burden of cardiovascular disease affecting the African American population. By examining transplant factors such as age, sex, and disease type a greater understanding of the trends of heart failure among the African American population can be gained. Our team has a unique whole-genome and transcriptome human heart Trans-Omics for Precision Medicine (TOPMed) data set, sponsored by National Heart, Lung and Blood Institute (NHLBI), (~750 paired DNA/RNA sequenced human heart samples), which includes males and females from different demographics paired with their respectively frozen tissue samples. Using the TOPMed dataset and our frozen tissue bank, we propose to study how African American's are affected by heart failure. For this, comparisons between race were made in order to see the risk level of the target population compared to others. The TOPMed dataset represented the following demographics which were used to compare to the target demographic: American Indian/Alaskan Native, Asian, Black or African American, Native Hawaiian/other Pacific Islander, White, etc. It was also important to understand the total average age when transplant or death occurred in the whole population comparted to the African American population in the data set. This information was then compared to the average age of transplant/death based on sex as well as disease types from the TOPMed dataset. Examining this data was coupled with imaging the samples using Mason Trichome and Hematoxylin and eosin staining and atomic force microscopy to see if there are significant differences in the African American population at the tissue level.
https://symposium.foragerone.com/2024-racas/presentations/65344

Exploring how the 2023 El Niño Evolved in Peru, Ecuador, the U.S. & Australia: Implications for Disaster Risk Reduction & Climate Justice.
Stefanie Varghese, Ruth Hundie, Luis Vargas, *Natural & Physical Sciences*
Mentor: Dr. Ivan Ramirez

Abstract:
Although the El Niño phenomenon, which is the warm phase of El Niño-Southern Oscillation (ENSO), is often defined by the U.S. National Oceanic and Atmospheric Administration's Oceanic (NOAA) Niño Index (ONI), other quantitative definitions exist that may better suit regional and country needs for early warning systems and disaster risk reduction. The existence of multiple definitions and the interpretation of how ENSO events evolve may confuse and hinder responses, as may have occurred in 2017. For example, there were conflicting climate information during that time. While the NOAA forecast projected neutral conditions in early 2017 (meaning no El Niño was present), some Andean countries were experiencing a localized extreme event with devastating consequences. In this presentation, we examined the development of the 2023 El Niño, and compared how the climate information from the U.S., Peru, Ecuador, and Australia agencies evolved and varied. Preliminary results will be discussed and the implications for disaster risk reduction and public health.
https://symposium.foragerone.com/2024-racas/presentations/65474

Exploring the Prefrontal Cortex to Amygdala Pathway in Conditioned Social Fear and Social Buffering in Rats
Cameron Davis, Timothy White, *Biomedical Sciences, Social Sciences & Humanities*
Mentor: Sondra Bland, PhD

Abstract:
Cameron Davis, Timothy White, Tyler Gerhart, Richard Montoya, Esteban Loetz, Jessica D Westerman, Carolina Sanchez Mendoza, Benjamin N Greenwood, Sondra Bland
Psychology Department at the University of Colorado, Denver
Anxiety, depression, and PTSD are common diagnoses following acute traumatic events. Despite a large body of literature studying trauma, there is a lack of research on identifying the implications of trauma in a social setting. A pilot study performed by our lab suggested that activation of the prefrontal cortex (PFC) to the basolateral amygdala (BLA) pathway was implicated in this social trauma response. We propose that conditioned social fear will result in decreased social behavior, but social buffering will result in increased social behavior. To test our hypothesis, we used a chemogenetic strategy to activate or prevent activation of the PFC to BLA pathway after injection of an agonist for Designer Receptors Exclusively Activated by Designer Drugs (DREADD).
On day one of behavior, all animals were injected with CNO and placed in the testing apparatus with a stimulus animal separated by a mesh divider. Two groups had the pathway activated or suppressed, (2 groups received the control virus) and then all but one group received 4 intermittent foot shocks. The following day the experiment animals were re-exposed to the stimulus animal without the mesh barrier, and their social interactions were recorded. This protocol assesses differences in social behavior and expression of plasticity-related proteins in the PFC and BLA in male and female rats. Behavioral analysis revealed that artificial activation of the PFC to BLA pathway was associated with an increase in social grooming on day 2, suggesting social conditioned fear rather than social buffering occurred resulting in decreased social behavior.
https://symposium.foragerone.com/2024-racas/presentations/65432

Exploring the relationship between the dorsolateral striatum and the hippocampus in contextual gating of fear extinction
Juliet Freund, *Biomedical Sciences*
Mentor: Dr. Benjamin Greenwood

Abstract:
Stress- and anxiety-related disorders are often treated with fear extinction-based exposure therapy, however, it exhibits poor long-term results. For example, context impacts fear extinction; whereby exposure to previously extinguished fear cues in a context different from where fear extinction was learned (e.g., outside of the therapist's office) elicits a return of fear, termed renewal. To improve the long-term efficacy of exposure therapy, research must be conducted to understand the neural pathways involved in fear extinction and renewal.
The hippocampus is one area that has been implicated in the contextual modulation of memory. However, it is not clear which hippocampal connections are used to activate this modulation during fear extinction. The dorsolateral striatum (DLS) is another brain region that has been implicated in fear renewal processes and is a possible link between the hippocampus and its role in fear extinction and renewal. This study specifically examines this dorsolateral striatum to hippocampus pathway (DLS-hippo) in the contextual modulation of fear extinction.
To identify whether the DLS projects directly to the hippocampus, we injected an adeno-associated viral vector (AAV) into the DLS of female rats. This virus will travel anterogradely from the DLS to brain regions that it directly interacts with. The AAV then produced a fluorescent protein, mCherry, over the course of four weeks after which the rats were perfused and their brains extracted for analysis. Immunohistochemistry was used to amplify mCherry signals for imaging.
The results from this experiment determined that the DLS directly projects to the hippocampus. This finding supports our idea that a DLS-hippo pathway is involved in contextual gating during fear extinction. Further research should be done on this pathway to better understand and enable the development of improved therapies for stress- and anxiety-related disorders.
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Exploring the Roles of Parents' Mental Health and Parenting Stress: What Predicts Engagement to a Brief, Telehealth Version of Behavioral Parent Training?
Gabriela Peralta Reyes, *Social Sciences & Humanities*
Mentor: Dr.Jacob Holzman

Abstract:
Behavioral parent training (BPT) is an effective intervention for many childhood behavioral health concerns and related parent outcomes (e.g. parenting stress). Yet, these benefits depend upon active parental engagement and many factors may affect engagement. As such, we adapted a BPT intervention to be brief (i.e., 6, 1-hour sessions) and delivered through telehealth to reduce engagement barriers. However, it is unclear if parental mental health concerns (PMHC) or parenting stress (PS) predict engagement challenges for this new BPT program.

A brief, group-based BPT intervention was delivered via telehealth to caregivers (n=34) of 3- to 7-year-olds at an outpatient behavioral health clinic. We hypothesized that PMHC and PS will be positively related to attendance as well as satisfaction. We explored the link between PS/PMHC and homework completion, which is understudied in BPT clinical trials. Primary caregivers completed measures assessing PMHC and PS before groups. Engagement was measured by attendance, weekly homework practice, and ratings satisfaction of intervention.
Correlations between PMHC, PS, and engagement outcomes were examined. Parents who endorsed more PS practiced homework more often (r = .42, p = .02). Similarly, parents who endorsed more PMHC practiced homework more often (r = .44, p = .02). Interestingly, PMHC and PS were not related to attendance (*r* range = -.05 to .13, *p's* > .47) or satisfaction (*r* range = -.09 to .27, *p's* > .16). While this study did not find evidence that caregiver stress was related to attendance or satisfaction, caregiver stress was related to homework practice.

These findings suggest that further research is needed to explore the relationships between homework practice and PS. Additionally, considering caregiver stress was unrelated to several engagement outcomes, further research is needed to understand whether adaptations to BPT's format decreases engagement barriers for parents who are experiencing significant stress.
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Exploring the Social Identities of First-Born Latinas: Examining the Influence of Familial Roles on Romantic Relationships and Mental Health
Isabella Luna, *Social Sciences & Humanities*
Mentor: Dr. Edelina Burciaga

Abstract:
The current state of mental health and counseling services oftentimes disregards the cultural nuances of Latinas, perpetuating systemic inequality by employing a one-size-fits-all model. This study focuses on answering the research question: how does Latino familial socio-culturalization influence the identity formation, roles, romantic relationships, and mental health of first-born Latinas? Utilizing sociocultural analyses of Latino morals/values, feminist theory, and childhood development models, I will conduct in-depth interviews with first-born Latinas who are between the ages of 18-35 years old, identify as cisgender women, and who are currently in or have been in a serious romantic relationship. The proposed study fills a gap in Latina/o sociology by bringing together the literature on the sociology of family and gender to better understand the experiences of first-born Latinas. This study will focus specifically on familial socialization, identity formation, and romantic relationships among first-born Latinas to shed light on the social experiences of this understudied and underserved population. Finally, this study will contribute to developing culturally appropriate community resources and counseling frameworks.
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Female Sex Hormones Increase the Activation of Substantia Nigra Dopamine Neurons during Fear Extinction

Miles Dryden, *Biomedical Sciences*
Mentor: Benjamin Greenwood

Abstract:
Learned fear is a principal component of stress-related disorders, such as generalized anxiety disorder (GAD) and post-traumatic stress disorder (PTSD). Extinction-based therapies are the predominant therapeutic intervention for these disorders; however, these therapies are susceptible to fear relapse. Furthermore, women are 60% more likely to experience anxiety disorders and twice as likely to experience PTSD than men. Despite this, sex differences in fear extinction remain understudied in the field of neuroscience. Prior studies suggest females exposed to extinction during estrous phases with high estrogen (proestrus and estrus; Pro/Est) have enhanced extinction memory and reduced relapse compared to their counterparts in phases characterized by low estrogen (metestrus and diestrus; Met/Di). We have recently found that the effect of estrogen on fear extinction is mediated by dopamine release in the dorsal striatum, a region involved in the strengthening of fear extinction memories. The principal input to the dorsal striatum is the substantia nigra pars compacta (SNc), a major dopamine-producing region of the brain. Estrogen could modulate extinction either by potentiating the activity of SNc dopamine neurons or increasing local dopamine release at SNc terminals in the dorsal striatum. My experiment aims to test the former mechanism and determine whether estrous phase impacts the activity of SNc dopamine neurons during extinction. We hypothesize that females exposed to fear extinction during Pro/Est will have potentiated activation of SNc dopamine neurons during fear extinction when compared to Met/Di females. We used immunohistochemistry to quantify the colocalization of c-Fos, a marker for neural activity, and tyrosine hydroxylase (TH), an enzyme responsible for synthesizing dopamine in the SNc following fear extinction. We observed greater activation of SNc dopamine cells in Pro/Est female rats when compared to Met/Di and male rats. Based on previous literature, we believe estrogen may be indirectly modulating SNc dopaminergic activity. Estrogen may instead be increasing local dopamine release in the dorsal striatum, which modulates the substantia nigra pars reticulata (SNr), a region that inhibits the SNc. The dorsal striatum both increases inhibitory and decreases excitatory outputs to the SNr, effectively silencing the SNr. This would increase SNc dopaminergic activity due to the lack of inhibition from the SNr.
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From Principles to Action: Affirming the Kurdish Right to Indigenous Self-Determination

Kani Murad, *Social Sciences & Humanities*
Mentor: Katherine Mohrman, Glenn Morris

Abstract:
This research investigates the applicability of international law and indigenous principles of self-determination to address the challenges faced by the Kurdish people. Through the analysis of relevant articles, this study presents analytical contributions that, when synthesized, suggest new avenues for undergoing self-determination in Kurdish enclaves. Utilizing an interdisciplinary approach that intertwines geopolitics, history, and international law, this research explores political attempts for liberation in an indigenous politics framework. The conclusion insists on the importance of Kurdish people actualizing their own political future, considering their geopolitical circumstances and the involvement of other marginalized peoples. A key concept is the true nature of self-determination, which is elaborated in this study using international legal documents, searching for both applicability and impediments. The versatility in the application of indigenous paradigms underscores the need for actualization of indigenous frameworks of self-determination with Kurdish contextual specificity. This research aims to introduce Kurds into an indigenous network of self-determination rather than limiting the Kurds to ethnic minorities and their possibility of self-determination to solely a nationalist movement. The objective of this study is the free and complete enactment of self-determination, as defined by international law, for underrepresented indigenous peoples in the Middle East.
https://symposium.foragerone.com/2024-racas/presentations/65526

From study participant to research assistant: Experiences of an undergraduate student investigator researching psilocybin use among BIPOC in Colorado
Madjelyn De Jesus, *Social Sciences & Humanities*
Mentor: Marty Otanez

Abstract:
Psilocybe cubensis, a psychoactive mushroom containing psilocybin and psilocin, induces euphoria, heightened sensory perception, emotional releases, and hallucinations upon ingestion. Traditionally used in various cultures, it holds particular significance in indigenous communities for medicinal and spiritual purposes. This project delves into the influence of psilocybin within Black, Indigenous, people of color (BIPOC) communities in Colorado, focusing on wellness via self-administration and ceremonial spaces where individuals consume psilocybin spiritual medicine. Emphasizing psilocybin's potential as a holistic mental health modality, the study draws on qualitative interviews with two indigenous facilitators as well as one presenter's (Madjelyn's) direct engagement in psychedelic healing. Also, we showcase Madjelyn's experiences as a study participant and research assistant in the same study. The project features findings from three video-recorded interviews from a total of 88 interviews in Colorado during 2023-24. Dr. Otañez served as principal investigator the study, "Psilocybin Use Among BIPOC Community Members in Colorado." We apply an arts-based approach to medical anthropology and auto-ethnography to examine self-administration practices of BIPOC, roles of ceremonial facilitators in medicine journeys, and the process of co-creating interdisciplinary projects with research participants. The visual narratives and lived experiences serve as compelling advocacy tools, offering a holistic exploration of wellness uses of psilocybin and the normalization of psychedelics. Our goals are to create cultures of support among BIPOC who consume psilocybin, contribute visual educational material to psychedelic policy makers, and encourage public health researchers to rethink researcher-participant relations in community-driven projects.
https://symposium.foragerone.com/2024-racas/presentations/65340

Future Water Warriors: Inspiring Environmental Scholars and Activists
Nakita Locklear, *Natural & Physical Sciences*
Mentor: Timberley Roane

Abstract:
This project hopes to inspire young students by sharing the importance of both water quality and our actions in keeping our environment clean. Using the research that students and faculty of the University of Colorado Denver are conducting at the Lowry Water Treatment Plant (located at the Lowry Landfill in Aurora, CO), this project aims to address how complex science can be communicated with middle school age students. This will be accomplished via a children's book that illustrates and introduces the concepts of water quality and microbiology. A particular carcinogenic contaminant, known as 1,4-dioxane, is being broken down by a microbiological source that has yet to be identified. This children's book will explain this process as well as what microorganisms are, where they can be found, and some of the amazing things they can do; such as degrading and removing chemicals from water. Using storytelling to communicate complex science, including the work at the Lowry Water Treatment Facility, helps science become more accessible and inclusive, a crucial step for engaging future generations of STEM scholars.
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Gender and Crime Depiction: Exploring the Intersection in True Crime Narratives
Makayla Mohr, *Social Sciences & Humanities*
Mentor: Melissa Tackett-Gibson

Abstract:
Gender plays a pivotal role in shaping societal perceptions, particularly evident in media portrayals of crime. This study delves into the portrayal of gender in true crime narratives and its association with causation. Through an examination of highly-rated crime documentaries on IMDB, it seeks to unveil nuanced

representations of men and women, analyzing their broader societal implications. Thematic analysis forms the core of this research, highlighting the intricate interplay between criminological characterizations, criminal motivations, and gender depictions in media. By shedding light on how gender influences narrative construction, this study offers valuable insights into societal perspectives on crime, justice, and gender roles, thereby deepening our understanding of this critical intersection.
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Geometric Mechanics of Hypar Metamaterials
Trevor Walker, *Tech, Engineering, & Math*
Mentor: Dr. Shengzhe Wang

Abstract:
Bulk materials often require substantial mass to achieve a desired mechanical performance. By leveraging efficient cellular geometries, metamaterials can improve the performance to weight ratio of their bulk counterparts, thus promoting sustainability through reducing material consumption and embodied energy. In this regard, lightweight honeycomb structures are recognized for their success in impact and compression applications due to their high stiffness- and strength-to-weight ratios. This work examines the mechanical properties of thin-shell hyperbolic paraboloid (hypar) umbrellas (inspired by the architecture of Felix Candela) to pioneer novel microarchitectures as an alternative to traditional prismatic honeycomb cells, thus combining architectural and bio-inspired design with material science. Symmetrical straight-edged hypar tympans are merged to form polygonal hypar umbrellas, as frequently seen in the architecture of Candela. These upright umbrellas are then superimposed with their mirrored (i.e., inverted) counterparts along the vertex to form a repeatable sandwich cell. Quasi-static compression tests were conducted on 3D-printed 3-, 4-, and 6- sided cells at a constant rise-to-area ratio. For the specimens studied, hypar-derived cells outperformed their prismatic and pyramidal counterparts, yielding an increased peak stress and Young's modulus up to 5.46 and 6.45 times, respectively. Similarly, six sided hypars exceeded their three- and four-sided counterparts by up to 1.45 and 1.27 times in peak stress and Youngs modulus, respectively. These enhancements to structural design and material performance benefit industries that require ultra-light and ultra-stiff materials such as construction, aerospace, and transportation.
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Girls defining skateboarding subculture: A case study of skateboarding feminism in Beijing, China
Yuki Wei, *Natural & Physical Sciences, Social Sciences & Humanities*
Mentor: Sarah Fields

Abstract:
Skateboarding has traditionally been perceived as a male-dominated sports domain, with case studies from Western countries summarizing the challenging circumstances faced by women in the skateboarding field, characterized by stigmatization, sexualization, and marginalization. However, findings from interviews and on-site observations reveal a different narrative. In mainland China, the skateboarding community boasts a substantial female participation, marked by a display of robust confidence. These women are perceived as possessing distinctive qualities of diligence and perseverance, endowing them with unique advantages in comparison to their male counterparts within the skateboarding domain. The burgeoning presence of a sizable community of female skateboarders in China, coupled with the discourse surrounding gender equality ingrained in Chinese culture, has indirectly influenced the landscape of the skateboarding industry. In an effort to engage a diverse customer base spanning both genders, skateboarding brands in China tend to focus on presenting the design and functionality of skateboards and related equipment in a straightforward manner. This research endeavors to analyze these distinct phenomena in China through a comparative approach, delving into the realms of Chinese feminist history, industrial distribution, and middle-class culture. Unlike perspectives centered on individual resistance, this study concentrates on deciphering the dynamics between ideological social structures and examining how systemic forces impact group cultures. Ultimately, the goal of this research is to provide a novel perspective on the feminist agenda, shifting the emphasis from highlighting

problems to recognizing the unique attributes of women. By doing so, it aims to underscore the potential for women to contribute irreplaceably to society.
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Girls defining skateboarding subculture: A case study of skateboarding feminism in Beijing,China
Yu Wei, *Social Sciences & Humanities*
Mentor: Sarah Fields

Abstract:
Skateboarding has traditionally been perceived as a male-dominated sports domain, with case studies from Western countries summarizing the challenging circumstances faced by women in the skateboarding field, characterized by stigmatization, sexualization, and marginalization. However, findings from interviews and on-site observations reveal a different narrative. In mainland China, the skateboarding community boasts a substantial female participation, marked by a display of robust confidence. These women are perceived as possessing distinctive qualities of diligence and perseverance, endowing them with unique advantages in comparison to their male counterparts within the skateboarding domain. The burgeoning presence of a sizable community of female skateboarders in China, coupled with the discourse surrounding gender equality ingrained in Chinese culture, has indirectly influenced the landscape of the skateboarding industry. In an effort to engage a diverse customer base spanning both genders, skateboarding brands in China tend to focus on presenting the design and functionality of skateboards and related equipment in a straightforward manner. This research endeavors to analyze these distinct phenomena in China through a comparative approach, delving into the realms of Chinese feminist history, industrial distribution, and middle-class culture. Unlike perspectives centered on individual resistance, this study concentrates on deciphering the dynamics between ideological social structures andexamining how systemic forces impact group cultures. Ultimately, the goal of this research is to provide a novel perspective on the feminist agenda, shifting the emphasis from highlighting problems to recognizing the unique attributes of women. By doing so, it aims to underscore the potential for women to contribute irreplaceably to society.
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Go Back to Your Country!: An Analysis of Hate Incidents During COVID-19
Jessica Valdez, *Social Sciences & Humanities*
Mentor: Dr. Melissa Tackett-Gibson

Abstract:
The emergence of COVID-19 led to an increase in hate incidents against the Asian/Asian-American and Pacific Islander community (AAPI). While not the first pandemic blamed on foreigners, or the first one blamed on Asian immigrants, it was one of the most recent that the world has experienced. These incidents encompass a range of hostile acts, including verbal and physical assaults, threats of violence, and vandalism targeting Asian-owned establishments, often invoking references to the COVID-19 pandemic. Beyond the immediate impact of such incidents, research demonstrates that bias related crimes affect victims more severely than non-bias crimes, resulting in instigating heightened fear and intrusive thoughts. To gain a better understanding of these incidents, an anonymous survey was conducted. This survey aimed to capture both the firsthand experiences of individuals and their vicarious experiences. One of the prominent themes that emerged was that these incidents took place in everyday and public places, such as at the grocery store, place of work, restaurants, parks, etc.

An analysis of the qualitative data has led to the proposal of several potential recommendations to address these incidents. The establishment of a reporting hotline or online reporting system could provide channels for citizens to report hate incidents. This in turn could be used to increase patrols in areas with increased hate crimes and hate incidents. Finally, the collaborative development of bystander intervention training programs, crafted by safety experts and community stakeholders can equip individuals with the skills to effectively intervene in instances of discrimination or violence. These measures are not only applicable to the AAPI

community but can have broader applications to addressing hate crimes/incidents in order to foster a safer society for all.
https://symposium.foragerone.com/2024-racas/presentations/65541

Grieving through Art: Mourning in the Victorian Era
Janelle Jimenez, *Arts & Media*
Mentor: Yang Wang

Abstract:
The art-historical value of post-mortem photography from the Victorian period is often overlooked because of its macabre nature. The grim view of this specific form of death portraiture has caused scholars to shy away from researching its cultural significance. Current scholarship has just begun to develop an appreciation for this art practice. The distinctive artistic practice of post-mortem photography, used to preserve the memory of the deceased, provides valuable insight into visual expressions of grief in the second half of the 19th century. This project analyzes the formal qualities and historical context of a set of post-mortem photographs from Europe and the United States. Although shocking to modern-day viewers, staged photographs of the deceased taken during the Victorian Era represent a shift in funerary practices that replace symbolic with explicit representation. This shift can be attributed to the popularization of grieving practices stemming from Queen Victoria and the advent of photography. The thesis argues explicit photographs of the dead helped mourners in their process of grief by providing concrete images for documentation and memorialization. Popularized during a period of photographic technology and visceral expressions of sorrow, Post-mortem photography from the Victorian period is a distinctive and short-lived art form worthy of examination.
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Guided Assembly of Carbon-Based Nanoparticles via Electrokinetics
Piper Malczewski, *Natural & Physical Sciences, Tech, Engineering, & Math*
Mentor: Randall Tagg, PhD.

Abstract:
The extreme, unpredictable effects of climate change are emphasized in industrially underdeveloped, low-middle income regions of the world. These effects will continue to grow unless special care is given to the climate resilience and energy poverty of such regions. There is regional and global climate demand for research in energy consumption and the ability to make the most efficient use of an energy source. Low-cost energy systems, which apply natural sources of carbon into devices that harvest or store energy, could both directly mitigate climate change and strengthen the resilience of regions vulnerable to its effects. Self-assembling nanomaterials have been an area of interest in industrial energy because they have demonstrated unique electrical and thermal conductivity, energy density, and malleability. These materials organize into definite geometries in response to applied electric fields. In application, this "guided-assembly" presents the possibility of exploring broadened applications, improved efficiency, and increased energy storage, due to unique nanostructure geometries. These self-assembling materials have shown promising applications for sensing devices, supercapacitors, and renewable energy harvest. This project has examined the effect of varied frequencies and electrode geometries on the morphology of self-assembling, carbon-based nanoparticles. We have examined colloidal suspensions of carbon black due to low-cost, accessibility, and possible interesting, amorphous atomic structures. The results have generated characteristic themes in electrokinetic phenomena observed at various frequencies and/or geometries. These identifications will contribute to a larger reference and ongoing work in guided assembly of carbon-based nanoparticles via electrokinetics. A novel technique for a “Lab-On-Chip" device fabrication is also presented here. This device has been designed uniquely to integrate experimentation parameters, such as geometry-specific electrodes and a sample well which will allow in-situ observation of bulk solution. The project will later explore the electrochemical properties of varied nanostructures assembled by electrokinetic phenomena. Applications in energy solutions will be considered and presented in the final culmination of this project.
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Gunslingers: A UCDenver Production
Jacob Thompson, *Arts & Media*
Mentor: David Liban

Abstract:
Since August of 2023, my peers and I have been hard at work in developing a short western entitled, Gunslingers, for the CU Denver FITV program. The short revolves around a former outlaw who tries to sway an ambitious young gunman who aims to steal his title by killing him thus earning a respectable level of notoriety. The script was brought into our senior thesis class and upon reading it, I was able to see the potential as I believed both characters represented certain mindsets that many have had at specific points in their life. The younger gunman represents a level of youthful ignorance, desperate to prove themselves and take on a massive burden without realizing what that would actually entail. Meanwhile, the former outlaw represents our ability to be humbled by our lived experiences and allowing ourselves to look back at those naive, youthful years with a more critical eye. Being an aspiring director, I was eager to help get this project off the ground and with the help of my peers, faculty, donors, and the EuReka Grant foundation, I was able to make that a reality. Working closely with my two lead actors, Lucas Swope and FITV's very own Eric Jewett, we were able to help bring life to the story's two central characters. In October of 2023, filming commenced over the course of three days at the MacGregor Ranch in Estes Park and the Four Mile Historic House in Denver. The experience of everyone involved was a positive and beneficial one as each member of the crew, myself included, had gained essential production experience and helped craft a compelling, character driven piece.
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High Estrogen During Learning of Novel Exercise Primes Future Increased Exercise in Female Rats
Kamryn Korth, *Biomedical Sciences*
Mentor: Benjamin Greenwood

Abstract:
Women face an increased risk of suffering from stress-related disorders compared to men. Despite the established stress relieving benefits of exercise, women fail to meet CDC exercise guidelines at a higher rate than males. In rats, females exhibit heightened responsiveness to the stress-protective effects of exercise, underscoring the value of studying this model. Female rats rapidly acquire and maintain voluntary wheel running (VWR), this effect is dependent on estradiol (E2), the primary form of estrogen. However, it is unknown how E2 affects the learning of a novel exercise. We hypothesized that rats learning VWR during the high E2 phase (proestrus) would show heightened running behavior over 3 weeks compared to lower E2 learners (metestrus and diestrus). To test this, 39 female rats were given access to running wheels for 3 weeks. Estrous phase was determined by cell characterization of daily vaginal lavage samples. One group was granted initial wheel access in proestrus (n=24), and the other in metestrus or diestrus (n=15). Wheel rotations were used to analyze running behaviors, most notably distance. Proestrus learning rats displayed increased running distances over 3 weeks compared to diestrus/metestrus learners, regardless of later phase (($F(3,38) = 3.05$; p $F(1,38) = .385$; $p > 0.05$). This supports our hypothesis that estrogen promotes novel exercise learning. These results could inform sex-specific strategies to increase exercise participation among both sexes and inform novel treatments of stress-related anxiety disorders.
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Histological Assessment of Hepatic Lipid Disposition in Fathead Minnows Exposed to Environmental Contaminants: Novel Grading Methodology and Implications for Endocrine Disruption
Leah Lusk, *Biomedical Sciences*
Mentor: Alan Vajda PhD

Abstract:
This study explores the effects of endocrine disrupting chemicals (EDCs) on patterns of hepatic lipid deposition in fathead minnows, aiming to improve our understanding of the impact of environmental toxicants on fish. Mobile laboratory experiments were conducted in 2018, 2019, and 2021 to expose fish to waters containing chemicals from a legacy fire-training area (FTA), a known source of per- and polyfluoroalkylated substances (PFAS). Liver samples were collected and analyzed to identify the pathologies resulting from chemical exposure. Using a novel histological scoring methodology. We identified morphological changes in hepatocyte histopathology and evaluated the prevalence and size of lipid droplets. Using novel scoring criteria, the livers of FTA-exposed fish and control fish were evaluated for a range of hepatocytic characteristics. The research is significant as it can help integrate findings on the exposure and effects of EDCs in humans. The study's findings have implications for human health as the chemicals that are contaminating water that may be consumed by populations living in these areas may have adverse impacts. Identifying the harmful effects of EDCs such as PFAS can lead to their removal from FTAs and other disposal sites and inspire the use of safer alternative treatments. This analysis will support future investigations of endocrine disruptors effects on hepatic toxicity.
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Honeybees (*Apis mellifera*) as a Biomonitor on Superfund Sites in Denver, CO, USA
Natasha Pember, *Natural & Physical Sciences*
Mentor: Christy Briles

Abstract:
Due to their global distribution and extensive foraging habits, honeybees as well as apiary products like honey, wax, and pollen have been shown to be useful as bioindicators of environmental contamination. This study establishes field and laboratory methods for measuring heavy metals and radionuclides in honeybees and hive products. Six hives were placed around the Denver Metropolitan Area in summer 2023 to sample heavy metals and radionuclides at superfund sites. Collected samples of pollen, honey, wax, and insects were minimally processed and then analyzed using ED-XRF, a more cost effective and accessible method than more typically used ICP-MS.
https://symposium.foragerone.com/2024-racas/presentations/65579

"If you want to decolonize psychedelics, let go of this idea that you need to pay a bunch of money to work with the medicine": Non-Dominant Cultural Members Narrate Wellness Stories and Concerns about Mainstreaming Psilocybin Mushrooms in Colorado
Mac Ervin, *Social Sciences & Humanities*
Mentor: Dr. Marty Otañez

Abstract:
Humans for millennia have desired mystical experiences and the healing powers that have been proven to produce positive effects on health, well-being, and prosocial behavior. Today, psychoactive fungi and plants such as psilocybin, peyote, ayahuasca, and iboga are stigmatized and viewed by some as having no medicinal value. Colorado voters passed Proposition 122 in November 2022, declaring that no person over the age of 21 can be criminally charged for possessing or gifting psilocybin and three natural plant medicines. Also, the new regulatory framework creates space for practitioners to legally provide psilocybin-assisted therapy in licensed wellness centers. Some indigenous people and their supporters claim that psychedelic-related policy and rule-making processes in Colorado are unresponsive to the concerns of the traditional keepers and holders of these medicines. Team members in the 2023-24 CU Denver BIPOC (Black, Indigenous, and People of Color) psilocybin research study conducted video and audio recorded interviews with 88 individuals about their use patterns and concerns about the decriminalization and legalization of psychedelics in the state. I discuss interview findings pertaining to views about equitable access to psilocybin, uses of this medicine to reduce depression and anxiety, and perspectives on the medicalization and corporatization of natural plant medicines. Also, I address the tension between the need to make psychedelic substances available in an

equitable manner for wellness purposes and the desire of indigenous elders and ceremonial leaders to respect sacred traditions.
https://symposium.foragerone.com/2024-racas/presentations/65425

Impact of Bone-anchored Limbs on Gluteal Muscle Volume and Composition
Mariana Ballard, *Tech, Engineering, & Math*
Mentor: Dr. Brecca Gaffney

Abstract:
Introduction: The transition between socket prosthetics to bone-anchored limbs (BALs) is an effective option for patients with amputation who cannot use a socket prosthesis. Although it is known that socket use results in hip muscle weakness that leads to asymmetric biomechanics [1], it is unknown how BAL influences the muscles. The objective of this investigation was to determine the influence of BAL use on the hip musculature.

Methods: Magnetic resonance (MR) images were collected at two timepoints relative to BAL surgery (baseline and 12-months after) in two patients. From the MR images, the gluteus maximus (GMAX) and gluteus medius (GMED) were segmented and used to calculate total muscle volume. Muscle composition was calculated based on the amount of fat and water signals within the MR images. Comparisons were made between intact and amputated limbs by calculating the percent change between timepoints.

Results: The GMAX volume increased on both limbs in one patient (intact: 7.27% and amputated: 9.48%) and had mixed changes across limbs for the other (intact: -5.53%; amputated: 3.37%). The GMED volume increased in both limbs for both patients (intact: (pt.1) 1.75%, (pt.2) 28.44%; amputated: (pt.1) 16.97%, (pt.2) 1.50%). The GMAX fat fraction percentage increased for both limbs in each patient (intact: (pt.1) 16.39%, (pt.2) 29.35%; amputated: (pt.1) 2.57%, (pt.2) 38.98%). The GMED fat fraction decreased on both limbs in one patient (intact: -6.84%; amputated: -2.46) and had mixed changes across limbs for the other patient (intact: 32.13%; amputated: -11.52%).

Significance: Increased muscle volume with BAL use suggests that muscle strength is increased with this novel prosthesis. Furthermore, GMED fat fraction was reduced with BAL use, which indicates better muscle quality as compared to a socket. BAL use had a positive influence on the GMED muscle, which may lead to improved biomechanics.
https://symposium.foragerone.com/2024-racas/presentations/65504

In Light of The Greeks: Evaluation of Internet Art Forms
Nicholas Takeda Kuroiwa Rangel De Oliveira, *Social Sciences & Humanities*
Mentor: Gabriel Zamosc-Regueros

Abstract:
With the rise of figures like Trump in the 2010s caused in part due to the proliferation of an internet culture that flowed downstream from 4chan, we can understand the history of the early 21st century as inseparable from the literary form that spawned this culture. As 4chan is a long-form text-based social media, the structure of its posts and the site's anonymity were extremely influential to the culture that became of it, with much of internet culture from memes, to what is considered "Cool" on social media largely coming from the sensibilities of the 4chan userbase. In this presentation, I will be previewing some of the ideas I have been working on for a paper. I will analyze the structure of 4chan's literary format and how it informs the culture of not only the site but reaches beyond, and contextualizes its influence on more "tragic" art forms or culturally producing mediums like short-form content and use this to further contextualize why we are seeing a resurgence of Alt-Right narratives on newer social media platforms, such as Tik Tok and Instagram that do not contain such "Alexandrian" literary forms. Focusing on the impact of the TikTok algorithm to understand short-form media content as a "miner" of history to find its subject matter. I will be drawing heavily from Nietzsche's conceptions of tragedy, the Dionysian, the Apollonian, and the Alexandrian to understand the effect that these different

literary forms have on their users in addition to contesting some reactionary narratives about the rise of social media, outlining how when utilized properly short form content qualifies itself as "tragic art" and has(or had, I will touch upon the potential failing of short-form content to produce long term results) the ability to redeem. while acknowledging potential challenges to my assertion (specifically, that short-form content cannot qualify as tragic art due to it dealing solely with phenomena) and countering them (by tracing the history of this form of content back to art forms that are tragic, specifically humor and music).
https://symposium.foragerone.com/2024-racas/presentations/65515

In The Gutter
Chynna Whittaker, Ian Walker, *Arts & Media*
Mentor: Eric Jewett

Abstract:
In the Gutter follows the story of two punked out, metal loving friends, living on the edge of poverty. With both being consumed by the fixed gear bicycle scene of the early 2000's Denver, they have spent the better part of their lives partying away the years with no responsibilities.

With rent and gentrification rising around the city, our main character, Kirk, has decided he wants more, and has taken a higher paying bicycle courier job in hopes of moving forward. However, Kirk's best friend, Bobby, is not concerned with growing up, and has borrowed his bike for an early morning beer run, but managed to get it stolen. This event forces Kirk to rely on Bobby as they set off on a journey through the back alleys of Denver in hopes of replacing the bike before work the next day.

Kirk is pushed and pulled in many directions, as drug dealers, junkies, and the homeless population attempt to pull him back in. Will he find a bike and move on? Or will he be forced to succumb to the only life he knows...partying?
https://symposium.foragerone.com/2024-racas/presentations/65323

In-person, Online, or Remote? Exploring CU Denver Students' Perceptions and Preferences for Three Delivery Modes of Learning
Siyu Qi, *Social Sciences & Humanities*
Mentor: Kari Alexander & Keith Guzik

Abstract:
Since the COVID outbreak in the early 2020s, in-person, online, and remote mixed modes of delivery have become commonplace at higher education institutions. Now four years later, it is time to understand students' experiences of learning through these three modes. This research explores CU Denver students' perceptions of the strengths and weaknesses of each of the three modes, as well as their preferences for the three modes and the reasons for them through a mixed qualitative and quantitative methodology of interviews and surveys, in an attempt to inform future curriculum development at the university.
https://symposium.foragerone.com/2024-racas/presentations/65440

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 contain possible human pathogens, but their sources and distribution remain understudied with modern methods. Using high-throughput DNA sequencing methods like metagenomics, large-scale

microorganism identification can be completed. Using hundreds of surface water samples from the Genome Resolved Open Watersheds project, we are characterizing the pathogenic potential of samples from freshwater ecosystems. The samples are highly varied and come from diverse locations, ranging from relatively pristine, 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 2093 Metagenome Assembled Genomes, candidate virulence-associated proteins were identified using homology searches against the Virulence Factor Database (VFDB). We identified 27,177 unique candidate virulence factor proteins using specific homology search criterion (e-value
https://symposium.foragerone.com/2024-racas/presentations/65546

Intermittent Fasting Improves Bone Fracture Healing in Obese Mice
Aaron Tran, *Biomedical Sciences*
Mentor: Dr. Honey Hendesi

Abstract:
Obesity is a risk factor for delayed fracture healing and fracture nonunion, which results in pain, disability, and increased medical costs. Studies on fractures in obese mice have revealed a reduction in cartilage and bone tissues crucial for endochondral new bone formation within the fracture callus, particularly noticeable at 21-day mark post-fracture, indicating delayed healing. Intermittent fasting (IF) is a dietary regimen known for its metabolic benefits, which have been shown to alleviate obesity-related pathologies.

This study aims to investigate whether IF can mitigate the adverse effect of obesity on fracture healing by enhancing callus cartilage content and promoting new bone formation. For this study, 18-week-old high-fat diet (HFD) fed obese male mice were divided into two groups: 1) continued free access to HFD (HFD-Adlib), and 2) subjected to every-other-day access to HFD (HFD-IF). After four weeks, mice underwent unilateral tibial fracture surgery. At 21 days post-surgery, fracture calluses were assessed using micro-CT and histology. Micro-CT scans of the tibiae were analyzed using a Scanco scanner and software was used for manual segmentation to measure bone volume/total volume of the calluses. Tissue segmentation and measurement of cartilage area within the calluses were performed using Qu Path software. Results were compared among HFD-Ad lib, HFD-IF, and a group of non-obese mice on a control diet.

Micro-CT and histology analyses revealed deteriorated callus mineralization and reduced cartilage content in HFD-Ad lib mice, which were restored to levels comparable to the control group in HFD-IF mice.

In conclusion, our study confirms that IF can enhance impaired fracture healing in obese mice and warrants further investigation as a potential strategy to mitigate the risk of fracture nonunion in obese patients.
https://symposium.foragerone.com/2024-racas/presentations/65501

Investigating Changes in Sputum Sample Quality Over Time
Bertina Quach, *Biomedical Sciences*
Mentor: Kristin Sturm

Abstract:
The Studies of Etiology of Rheumatoid Arthritis (SERA) project was initiated in 2004 and is an ongoing project aimed at identifying biomarkers associated with Rheumatoid Arthritis (RA). RA is an autoimmune disease where the immune system attacks the healthy cells in your body, leading to painful deformities and bone erosions. The SERA project looks at sputum sample quality, particularly at cell viability and squamous epithelial cell count. A higher cell viability indicates higher sample quality of sputum. However, a higher count of epithelial cells means lower quality while a lower count means higher quality. Immune cells such as neutrophils and macrophages play an important role in looking at RA. Therefore, it is important to have as many neutrophils and macrophages in a sputum sample. The primary focus of this research project is investigating the historical data for sputum quality, particularly cell viability and squamous epithelial cell count over the

years. This can further achieve the goal of the SERA project and help improve lab protocols. The sputum samples were collected in a ventilated booth where participants inhaled salt water mist. It was revealed that significant differences in squamous epithelial cell counts are found between 2014, 2019, and 2023, and between 2015 and 2023. Cell viability has significant differences between 2020 and 2021, 2022, and 2023. Factors for these differences in epithelial cells and cell viability over time can be the use of equipment, staff differences, processing delays, techniques, and storage conditions. Furthermore, participants' differences in producing quantities of sputum and sample contamination can also cause these differences as well. Overall, to ensure high numbers of neutrophils and macrophages, it is important to process samples properly and adhere to lab protocols for greater sample quality for RA research.
https://symposium.foragerone.com/2024-racas/presentations/65530

Investigating Eye Movements and Reading: Impacts of Language and Audio Input
Mia Jannika Lim, *Social Sciences & Humanities*
Mentor: Carly J. Leonard, Ph.D.

Abstract:
It is obvious that we are surrounded by a world where we see so much information, but you may have never thought of how often our eyes move. Eye movements are impacted by what a person is visually attending to. During reading tasks, the eyes are frequently moving due to attention fixating on different locations as the text is processed. When your eyes are fixating, two things are happening: the processing of the word you are fixating on and the processing of peripheral information to decide where your eyes will move next. Previous eye tracking research studies on reading have found the most common eye behaviors during reading tasks are fixations (brief pauses or stops), saccades (rapid series of eye movements), and regressions (looking at previous words within the text). Different models of eye movement control, such as serial-attention models (e.g., E-Z Reader) and parallel-attention models (e.g., SWIFT) also impact the way researchers interpret the connection between reading and attention. For example, a study by Jarodzka & Brand-Gruwel (2017) highlighted the concept that lexical processing (i.e., word recognition) occurs during a fixation, and a reader will not saccade to a new location until this processing is finished. This evidence suggests a serial operation of attention is underlying eye movement decisions. There are also many other factors that could impact the course of eye movements during reading tasks, such as auditory input and language. For example, in a study on reading-only and reading-while-listening modes by Conklin, Alotaibi, Pellicer-Sánchez, and Vilkaitë-Lozdienë (2020), it was discovered that first-language speakers (L1) had longer fixations when reading with an auditory input versus second-language speakers (L2) who showed no facilitation. This presentation will overview the literature examining how attention and eye movements during different reading tasks are influenced by language and auditory input.
https://symposium.foragerone.com/2024-racas/presentations/65511

Investigating the Restorative Effects of Nature on Attentional Control
Cay Beckman, *Social Sciences & Humanities*
Mentor: Jason M. Watson

Abstract:
Attention Restoration Theory (ART) explains that engagement with nature settings allows for the replenishment of attentional resources that are drained by cognitively taxing activities. Further, ART claims that exposure to nature inactivates voluntary attention allowing its restoration. However, contradictory to ART, previous studies have found that an individual's voluntary attention may be active and is instead being re-calibrated based on the individual's level of engagement with nature. This study aimed to determine whether viewing images of nature versus urban settings of either high or low fascination differentially impacted the extent of attention restoration. It was hypothesized that attentional control, measured by performance on incongruent flanker trials, would exemplify optimal engagement and thus the greatest restoration of attention after viewing high fascination nature images. Participants engaged in 80 flanker task trials, in which participants were presented with a row of arrows and were instructed to indicate the direction of the central target arrow (left or right) as

quickly and as accurately as possible while ignoring the outside arrows. The flanker task presented congruent (>>>>>) and incongruent (
https://symposium.foragerone.com/2024-racas/presentations/65459

Isolation of Various Bacteria Capable of Using 1,4-Dioxane as Sole Carbon and Energy Source Helps Bioremediation of Contaminated Groundwater.
Wilshekiah Evans, *Natural & Physical Sciences*
Mentor: Timberley Roane

Abstract:
Abstract
1,4-Dioxane is a potentially carcinogenic organic compound used in many common household and industrial products that can leach into waterways and groundwater. Chemical methods to decrease the concentrations of 1,4-dioxane can be time consuming, costly, and produce toxic byproducts. Bioremediation of 1,4-dioxane and other organic compounds carried out by microorganisms is an alternative inexpensive and effective way to remove 1,4-dioxane from contaminated waters. This study focuses on isolating and identifying microorganisms that can use 1,4-dioxane metabolically as a sole carbon and energy source. Many bacteria are recognized in the degradation of 1,4-dioxane such as *Acinetobacter baumannii* DD1, *Ancylobacter polymorphis* (ZM13), *Rhodococcus ruber* 219, and many more from the genus *Pseudonocardia*. Studies show that up to 59.95mM out of 60mM of 1,4-dioxane can be removed by degrading bacteria species *Ancylobacter polymorphis* (ZM13) isolated from a microbial consortium (Chuhan et.al. 2022). Furthermore, bacteria from the genus *Pseudonocardia* are well-known candidates for 1,4-dioxane degradation, specifically *Pseudonocardia dioxanivorans* CB1190 which can degrade 20mg/L in 4 days (Inoue et.al. 2016). For this study, microbial communities in 1,4-dioxane contaminated groundwater aquifer at the Lowry Water Treatment Facility will be analyzed for the presence of 1,4-dioxane degrading bacterial species. Currently, microorganisms at Lowry Water Treatment Facility are removing approximately 97% of the 1,4-dioxane. The goal of the work here is to see if we can increase this percent removal through the detailed study of the bacterial species currently involved in 1,4-dioxane degradation. This study will isolate bacteria on media amended with 1,4-dioxane; will monitor 1,4-dioxane degradation upon growth; and will use the 16S rRNA gene for species identification. With this information we will then associate what nutrients/limiting factors these microbes need to maximize their survival and reproduction to optimize continued degradation and bioremediation of the contaminated groundwater.
https://symposium.foragerone.com/2024-racas/presentations/65437

Kennedy Family Legacy
Lauren O'Brien, *Arts & Media*
Mentor: Hans Rosenwinkel

Abstract:
This presentation delves into the illustrious Kennedy family dynasty through the lens of Robert F. Kennedy Jr., focusing on the enduring legacy that has defined the Kennedy name. By casting a wide net, this research encompasses an extensive array of archival materials, including government documents, publications by and about RFK Jr., media coverage across various platforms, and a rich collection of speeches and interviews from the Kennedy lineage. This comprehensive approach aims to present an unbiased exploration of RFK Jr. using the Kennedy family's historical impact on American society for his current political pursuits.

Navigating the complex political landscape and media representations posed a significant challenge, necessitating a meticulous and balanced approach to research. This endeavor revealed the profound depth of the Kennedy dynasty's influence, tracing its roots even before JFK and RFK Sr.'s transformative roles in American history. The presentation highlights RFK Jr.'s professed efforts to carry forward his family's legacy, advocating for values of inclusivity, diversity, and social justice, resonating with the foundational principles laid by his forebears.

Intended for a diverse audience of students and the public, this media-rich presentation not only sheds light on the Kennedy's historical significance but also ignites a conversation about the timeless relevance of their ideals in today's society. Through this exploration, we are reminded of the indelible mark the Kennedy family has left on America, urging us to reflect on the enduring values that continue to shape our national discourse.
https://symposium.foragerone.com/2024-racas/presentations/65350

Krypton - the energy efficient atom?
Jessica Paredes Saltijeral, *Natural & Physical Sciences*
Mentor: Kathryn R. Hamilton

Abstract:
In order to preserve our planet for future generations to enjoy, we as a society must take steps to better manage our natural resources. One way we can do this is by adopting sustainable, energy-efficient materials. Identifying these materials is difficult to do, and often is done by a “trial and error” approach, which itself can be wasteful of resources. Ultimately, a material’s chemical and physical properties are determined by the arrangement of its constituent electrons. Therefore, by performing detailed calculations of the electronic structure of elements we may be able to determine their suitability in energy-efficient materials. In this project we seek to calculate the energy levels of the electrons in Krypton atoms. Krypton is already used in low-wattage LED bulbs and energy-efficient windows, but could potentially have other applications which have not been found yet due to the lack of knowledge of its atomic structure. Past experiments have tried to identify some of Krypton’s electron energy states, but they have found it difficult to do because there are a large number of them and they are closely spaced in energy. We seek to determine what energy levels exist within Krypton in the range from 22 eV to 32 eV. Our main tool for conducting this study is the Dirac B-spline R-matrix (DBSR) program. The DBSR program models the excitation of Krypton through electron collisions, and returns all possible energy states of Krypton by solving the Time-Independent Schrödinger equation (TISE). Our calculations reveal multiple energy states in the range from 22 to 32 eV. With these high energy states and states that have already been determined, we make progress in the description of the arrangement of Krypton’s electrons. This allows us to better understand the properties of Krypton, and could lead to uncovering new energy-efficient uses for Krypton.
https://symposium.foragerone.com/2024-racas/presentations/65482

Kynurenine Levels in Acute Ischemic Stroke Patients with and without Post-Stoke Infection
Ian Espinoza, *Biomedical Sciences*
Mentor: Dr. Layne Dylla

Abstract:
Objective*:* Tryptophan metabolism via the kynurenine pathway is associated with poor ischemic stroke outcomes and can lead to immunosuppression in other contexts. This study's objective is to characterize differences in tryptophan metabolism via the kynurenine pathway in acute ischemic stroke patients with and without a post-stroke infection.
Methods*:* This study analyzed whole blood samples from acute ischemic stroke patients enrolled in the University of Colorado Emergency Medicine Specimen Bank between March 20, 2018 and March 20, 2023, using high throughput mass spectrometry-based metabolomics. We determined the absolute quantification of tryptophan, kynurenine, kynurenic acid, and quinolinic acid levels. We used descriptive statistics to characterize the cohort and individual metabolite levels. A two-sample t-test compared the absolute metabolite levels in patients with and without a post-stroke infection.
Results*:* There were 110 patients with an average age of 65.3 years, and of whom 50% were male, 68.2% were white, and 20.0% were Hispanic. There were significantly increased average levels of kynurenine in individuals with post-stoke infection (2.0μM, standard deviation [SD] 0.9μM) compared to those without a post-stoke infection (1.6μM, SD 0.8μM) (p=0.04). Individuals with post-stroke infection had slightly lower levels of tryptophan (34.3μM, SD 13.8μM), and increased levels of quinolinic acid (12.2μM, SD 3.2μM) and kynurenic

acid (0.08μM, SD 0.14μM) compared to those without a post-stroke infection (tryptophan: 37.3μM, SD 9.9μM, p=0.32; quinolinic acid: 11.4μM, SD 3.1μM, p=0.28; kynurenic acid: 0.05μM, SD 0.08μM; p=0.3).
Conclusion*:* Acute ischemic stroke patients with a post-stroke infection have increased levels of kynurenine compared to those without a post-stroke infection. This may contribute to immunosuppression leading to post-stroke infections. Further research will determine if pharmacological manipulation of kynurenine levels could combat post-stroke infections.
https://symposium.foragerone.com/2024-racas/presentations/65320

Lactate Assays Link to Pluripotency in Mouse Embryonic Stem Cells
Farahnoz Sanginova, *Biomedical Sciences, Natural & Physical Sciences*
Mentor: Christopher Phiel

Abstract:
Glycolysis is a metabolic pathway within the cells which plays an important role in providing cells with energy via the breakdown of sugars such as glucose and fructose. This pathway has been proven to be important in embryonic stem cells. A high cellular metabolism has been shown to be linked to stem cell pluripotency, with cells experiencing high levels of proliferation and glycolysis to sustain their rapidly dividing state. Epigenetic modifications, such as histone methylation and acetylation, also play an important role in stem cell biology. Recently, a new histone modification – lactylation – has been linked to embryonic stem cell pluripotency. This observation is intriguing since it would directly connect cellular metabolism with epigenetics and the regulation of gene expression. Lactate is the end-product of glycolysis. Given the potential effects that lactate can exhibit epigenetics, it is important to understand whether lactate levels change in embryonic stem cells in response to modulators of glycolysis. In this investigation the effects of different nutrient compositions of media on lactate production levels were measured in mouse embryonic stem cells. Bioluminescent lactate assays were employed to detect and quantify concentrations of L-Lactate in mouse embryonic stem cells in different types of media. Four different media formulations were employed: regular media containing 4.5 g/L glucose (DMEM), DMEM with no glucose, DMEM with high fructose (9 g/L) and DMEM with high glucose (9 g/L). We measured intracellular lactate, extracellular lactate, and total lactate levels from embryonic stem cells. Results were quantified with the use of bioluminescence on a plate reader. The results have shown a steep increase in intracellular lactate concentration in cells treated with high fructose media in the absence of glucose, however this effect is not specific to fructose as high glucose had the same effect. Taken together, these data show a way of measuring effects of histone modification on embryonic stem cells.
https://symposium.foragerone.com/2024-racas/presentations/65731

Lead (pb) tolerance in mycorrhizal fungi *Suillus brevipes* and *Suillus tomentosus*
Matt Johnson, *Natural & Physical Sciences*
Mentor: Sara Branco

Abstract:
Soil lead (Pb) contamination is widespread and negatively affects organisms. Some fungi can thrive in soils with high metal content. Lead contamination levels are high in the Rocky Mountains due to historical mining activity, however it is not clear if fungal species from this region are Pb-tolerant. We investigated Pb tolerance in *Suillus tomentosus* and *S. brevipes* isolates from Pb contaminated and non-contaminated sites in Colorado. We expected isolates from contaminated sites to display high levels of Pb tolerance, and isolates from non-contaminated sites to be Pb sensitive. We also hypothesized both species would show similar levels of Pb tolerance that would positively correlate with tolerance to other metals. Unexpectedly, there was no correlation between Pb soil contamination and Pb tolerance in either species. We however found that *S. tomentosus* is more Pb tolerant than *S. brevipes* and that both species show large intra-specific variation regarding Pb tolerance. We found no relationship between growth rate and Pb tolerance in both species. There was a positive correlation between Pb and zinc tolerance only for *S. brevipes* and no correlation between Pb and cadmium tolerance for either species. Our results show that even though some *S. brevipes* and *S. tomentosus* isolates display Pb tolerance, it is difficult to predict where tolerance arises. Pb tolerance in

Suillus from the Rocky Mountains is an important finding, as these fungi can be used as a tool for the recovery of local habitats impacted by Pb contamination.
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Life Under Hugo Chavez
Claire Balmas, *Social Sciences & Humanities*
Mentor: Ryan Crew

Abstract:
Hugo Chavez was a controversial leader whose legacy is still very polarized in the public eye. Most authors who write on his policies and person still only focus on the higher-level understanding, looking to community leaders, politicians, and Chavez himself to compile research and find answers. This project looks to help bring balance to the view on Chavez, but instead of focusing on sources already tapped, focusing on the everyday people who lived under his rule.
This project has three phases: the first is examining the current writings and documentation on Chavez in a detailed essay and historiography; the second is to conduct a series of interviews with a cross section of immigrants from Venezuela on their personal experiences living under Chavez's government; and finally compiling these stories into a book to help fill in the current gaps of the historiography on Chavez. Currently this project is in phase one and will be moving into phase two this summer with the final project completed by the end of 2025.
By compiling interviews and personal stories the life of a common person under Chavez's rule comes to life to give a day to day understanding of what his policies meant to Venezuela as a whole. By compiling these stories we get a real look at gulf between scholarly understanding and personal experiences; get a balanced view of the positive and negative impacts of his rule on the people; and truly understand the legacy of Chavez in the memory of the Venezuelan people that were directly affected by his policies.
https://symposium.foragerone.com/2024-racas/presentations/65465

Loading Asymmetries with Different Transfemoral Prosthesis Types at Multiple Speedsng Asymmetries with Different Transfemoral Prosthesis Types at Multiple Speeds
Grace Georgiou, *Tech, Engineering, & Math*
Mentor: Brecca Gaffney

Abstract:
Patients with amputation have more biomechanical asymmetries compared to healthy counterparts. This asymmetry can lead to overuse injuries, such as osteoarthritis and low back pain. These issues can also be compounded when patients have ill-fitting socket prosthesis. Bone-anchored limbs (BALs) are a novel alternative to a traditionally prescribed socket prosthesis. Due to the novelty, we are still learning how BALs affect biomechanics. Past research has focused on walking at only one speed. This is a limitation because when speed changes so do forces. Our objective was to compare ground reaction force symmetry in different walking speeds in socket and BAL users in both the anterior/posterior and vertical direction. Overground walking data was collected from 6 participants with transfemoral amputation (3 with BALs, 3 with sockets) at a self-selected and fast speeds using motion capture and force plates in the ground. The ground reaction force impulse was calculated during three stance periods per limb at each walking speed and used to calculate a symmetry index. In the vertical direction there were no major differences in asymmetry in the socket population compared to the BAL population at either speed. However, in the sagittal plane in the first half of the stance period there were more asymmetries seen by a lower asymmetry index score in the BAL users compared to the socket users, with asymmetries increased during the fast walk. Then, in the second half of gait there are no conclusive trends to be seen. This could mean that BAL users may be avoiding overloading the amputated limb, particularly at faster speeds. Further research would need to be performed to understand why this occurs. In the future loading symmetry should remain a priority in rehabilitation with an additional focus on rehabilitation at different speeds to reduce the risk of further injury.
https://symposium.foragerone.com/2024-racas/presentations/65402

Malondialdehyde Modification Decreases Membrane Binding by secretory C2 Domains
David Soto, *Natural & Physical Sciences*
Mentor: Jefferson 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-4 (SLP) and SLP-5, membrane-binding proteins in the secretory pathway, are targets 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-4 and 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 C2 domains using a well-established liposome binding assay. Then we will react the C2 domains with MDA. If Slp 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 and similar proteins in the insulin secretory pathway.
https://symposium.foragerone.com/2024-racas/presentations/65490

Maternal Mental Health: A Qualitative Interview Study of Maternal Health Providers in the United States
Maleeha Shah, *Social Sciences & Humanities*
Mentor: Dr.Hyeyoung Nelson

Abstract:
Background: One in five individuals suffer from a mental health disorder during pregnancy or in postpartum in the US, yet few have their mental illness identified or treated. Research reveals that individuals of color, particularly Black and Indigenous people, and the under- and uninsured are at greater risk of experiencing untreated perinatal mental illnesses.
Methods: This paper presents interview data with 20 individuals who provide maternal healthcare and/or birth and postpartum support in the US regarding their experiences with maternal mental healthcare in the US.
Results: Nearly 40% of the women experienced perinatal mood disorders that were never identified or treated by their healthcare providers. This lack of treatment stemmed from a combination of factors including the women's failure to honestly report mental health concerns alongside ineffective mental health screening protocols administered during newborn pediatric visits. These experiences differed from maternal health providers' perspectives, which assumed that failure to identify and treat mental health conditions were largely tied to lack of insurance, which notably none of the women in the sample lacked. Providers also noted that insufficient resources for mental health support was another crucial problem, as it impacted the types of treatments and support available during pregnancy and in postpartum.
Conclusion: These interviews reveal a disconnect between the women's experiences navigating mental health issues, especially in postpartum, and providers' understanding of the persisting maternal mental health crisis in the US, pointing to areas of practice and policy that should be targeted for improved maternal health.
https://symposium.foragerone.com/2024-racas/presentations/65462

Measuring Photo-ionization Times of Single Atoms
Parinoz Abdulloeva, *Natural & Physical Sciences*
Mentor: Kathryn Hamilton

Abstract:
Living in high altitudes is alarming given that the chances of having skin cancer are much higher, but what is skin cancer? Skin cancer is the damage caused to a person's DNA through UV radiation, or simply, the sun. New studies, discoveries and medications are constantly being put on trial in hopes of treating this fast-damaging disease. However, inventing an effective treatment is especially difficult when so little is known at the fundamental level about how this damage occurs. How this light- matter interaction causes DNA damage is one of the big
questions of modern medicine. To answer this question, we need to study light and matter at their natural scales, the behavior of individual photons and electrons. These particles have incredibly small masses, and move incredibly quickly, so they are difficult to study in a laboratory. However, computational research has made its way up in efficiency and accuracy, making it an excellent method to tackle this problem. My research focuses on how long it takes for an electron to absorb an individual photon. On the human time scale, photons are absorbed by electrons at a seemingly instantaneous rate. However, on the time scale of electron behavior, this process has a nontrivial time value. By measuring this time difference between a photon nearing an electron and then being absorbed, we can begin to further the applications of this discovery to other life sciences like medicine, and topics like DNA damage (cancer), photosynthesis, and the logistics of human vision.
https://symposium.foragerone.com/2024-racas/presentations/65663

Metabolomic Analysis of Environmental Toxins in CKDu Research: Investigating Implications on Kidney Function
Sarah Le, *Biomedical Sciences*
Mentor: Arthur Stem, Jared Brown

Abstract:
Metabolomic analysis plays a crucial role in identifying biomarkers associated with physiological conditions and disease states. In this study, metabolomic data were analyzed to explore potential nephrotoxic metabolites and their implications for kidney health. The data were visualized in a fold change heat map and principal component analysis plot to uncover patterns and relationships among metabolites. Several metabolites of interest were identified, suggesting a complex relationship between environmental exposures and kidney health. These findings provide insight into the potential role of environmental factors in contributing to the epidemic of chronic kidney disease unknown etiology (CKDu), particularly in populations exposed to high exertion work and nephrotoxicants in hot climates.
https://symposium.foragerone.com/2024-racas/presentations/64980

Metacognitive Disparity Among CU Denver's First-Generation STEM Students
Desiree Starzyk, *Natural & Physical Sciences, Social Sciences & Humanities*
Mentor: Dr. Priscilla Burrow

Abstract:
First-generation college students often face a multitude of unique challenges navigating the academic landscape in comparison to their multigenerational peers. Amongst these challenges, they are often not acclimated to the pedagogy and academic expectations present in higher education institutions. The initial aim of this research was to assess the correlation between the use of metacognitive activities and student success in general chemistry courses at the University of Colorado Denver, which further highlighted a disparity in metacognitive practices between first-generation college students and their peers. Metacognition–the awareness and regulation of one's own cognitive processes–plays a crucial role in academic success through enhancing student engagement, motivation, problem-solving, and self-regulation. In the context of college

chemistry and other college STEM courses, metacognitive awareness can serve as a major benefit, if not a necessity, to students due to the demanding nature of the subject matter and the intricate cognitive processes involved in understanding and applying complex topics. The initial analyses showed a positive correlation between Metacognitive Activities Inventory (MCAI) scores and grades achieved by students enrolled in college general chemistry at CU Denver ($t(498)=0.09$, $p=0.034$). Results from the second analysis indicated that first-generation students have significantly lower scores ($t(391)=3.201$, $p=0.015$). Understanding these disparities is essential for developing targeted interventions and support systems to enhance not only the academic success of first-generation college students but could prove beneficial to improving the learning practices of all students.
https://symposium.foragerone.com/2024-racas/presentations/65528

Modified Cell Stressor for Mimicking the Conditions of the Heart
Vera Kilman, *Biomedical Sciences, Tech, Engineering, & Math*
Mentor: Brisa Peña Castellanos

Abstract:
Heart failure has been one of the most challenging issues in the medical field, and yet still one of the most common. According to Heart Failure Society of America, 6.5 million Americans over the age of 20 have heart failure. Despite this, diagnosing and treating heart failure has proved to be one of the most formidable obstacles for scientists and doctors alike. It is extremely difficult to replicate the cardiac conditions in an artificial environment, and current technologies only provide targeted conditions rather than the complete environment of the heart.
This project aims to develop a device that can apply physiological and pathological stresses experienced by the human heart. Our goal is to modify the current cell stressor which our lab uses, automating the functionality and incorporating flow to introduce shear stress. Our lab strives to advance the understanding and treatment of heart failure, ultimately improving patient outcomes and quality of life.
https://symposium.foragerone.com/2024-racas/presentations/65494

NMR investigation into the depletion of cellular microRNA let-7b by SARS-CoV-2 Nsp9
Qingxuan Fei, *Biomedical Sciences*
Mentor: Woonghee Lee

Abstract:
The non-structural protein 9 (Nsp9), which is a member of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) family, is known to contribute to coronavirus infections that had a widespread global impact. Nsp9 plays crucial roles in viral replication and transcription mechanisms, and acts as a crucial RNA binding subunit. Let-7b is a crucial member of the let-7 microRNA (miRNA) family, acting as a tumor suppressor, regulating gene expression and other biological processes by binding to Quaking RNA binding protein (QKI). We hypothesize that when a patient is infected, the elevated level of Nsp9 disrupts the cellular environment by hijacking let-7b, which would be bound to QKI, and causing its deficiency. To elucidate our hypothesis, we use nuclear magnetic resonance (NMR) spectroscopy as a tool. NiRAN-RdRps (RNA-dependent RNA polymerases of the Nidovirales) interact with the N-terminal domain of a nonstructural protein (Nsp). It is known that the first asparagine (N1) residue of Nsp9 is a main actor in RNA binding processes, and NiRAN-RdRp activity and Nsp9 NMPylation are essential for coronavirus replication. To evaluate the significance of N1 in the N-terminal domain, we study wildtype Nsp9 (wtNsp9) and its mutants Nsp9-N1A and N1D by NMR perturbation studies. We perform the ^{1}H, ^{15}N-HSQC experiment on these proteins with and without let-7b and see the interaction site based on the chemical shift changes. The POKY suite is used to detect the changes and visualize on the three-dimensional (3D) structure of Nsp9 to identify the specific binding site of Nsp9. We plan to study QKI and its let-7b binding by NMR as well. From competitive binding analysis between Nsp9 and QKI against let-7b, we will be able to validate our hypothesis and also provide new directions for therapeutic interventions and the design of new medicine by improving the knowledge of viral pathogenesis.
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Non-Linear Dynamics of the Colpitts Oscillator
Caleb Kinkade, *Natural & Physical Sciences*
Mentor: Randy Tagg

Abstract:
Self sustained oscillatory systems convert a steady power supply into a periodic, time varying output. Examples of such systems are present throughout the world, e.g., the beating hearts of animals or the reference clock within telecommunications electronics. An archetype of electronic oscillators is the Colpitts oscillator circuit, in which the frequency of oscillation is set by a resonant “tank circuit.” This tank circuit is made of one inductor and two capacitors that is shown experimentally to “ring down” like a struck bell when the circuit is briefly energized. The Colpitts oscillator takes output from the resonant tank and feeds it back into a transistor, i.e., utilizes feedback, in order to sustain oscillation. The dynamics of the Colpitts oscillator transistor circuit is expressed as a system of eight ordinary differential equations of voltages and currents at various points in the circuit. DC analysis of these equations reveals a DC bias point, or fixed point within the dynamical system. The full dynamics are simulated numerically via the Runge-Kutta method. The simulation is compared with a physical model of the circuit.
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Non-Magnetic Cart for Supporting Fluxgate Gradiometers
Zachary Stedman, *Natural & Physical Sciences*
Mentor: Bodhi Rogers

Abstract:
Fluxgate gradiometers play a crucial role in archaeology by detecting subtle variations in magnetic fields, aiding in the identification of buried structures and artifacts. The non-magnetic cart serves as a critical platform for deploying and maneuvering these highly sensitive instruments during field tests. With careful design, the cart provides stability, mobility, and optimal positioning for the gradiometers which improve efficiency and reliability. My research focuses on optimizing the design of a non-magnetic cart to support fluxgate gradiometers for archaeological surveys. A previously designed cart, Mark I, suffered structural deficiencies and lacked durability during field tests. Using the Fusion 360 files from the previous design iteration, I have taken a systematic approach to address these issues. Initial testing with the Mark I cart revealed structural failures, prompting me to design a more robust Mark II cart. Improvements include reinforced connections, relocation of instrumentation, and redesigned sensor mounting mechanisms to ensure optimal positioning and easier calibration. To minimize magnetic interference, the non-magnetic cart consists of plastic, carbon fiber, and degaussed aluminum components. Data collection will utilize a pair of data loggers connected to the set of four gradiometers, which will transmit real-time readings to a tablet. This is also aided by a GPS with centimeter-accurate positional data. Comparative analysis of collected data will provide insights into the efficiency of the Mark II cart's design enhancements. My efforts are ongoing to familiarize myself with the mapping software and understand the intricacies of the real-time data readings for field testing. Certain complications have become apparent, particularly concerning the power supply and connection issues which have prevented me from data collection. Overcoming these obstacles remains a priority to ensure the successful execution of comparative field surveys with both the Mark I and Mark II cart designs.
https://symposium.foragerone.com/2024-racas/presentations/65598

Optical Waveguides and our Everyday Lives
Sean-Michael Walker, *Natural & Physical Sciences*
Mentor: Dr. Masoud Asadi-Zeydabadi

Abstract:
Many studies have shown practical applications of optical waveguides and how understanding and changing their configurations allows for more efficient communications and even internet delivery as fiber optics. Here I describe what waveguides are in detail, the structure of waveguides, the theory used to model them, a computational analysis of waveguides with different configurations utilizing Meep (an open source electromagnetics simulation package), and an analytical comparison of these results to known analytical solutions. Utilizing this knowledge can lead to more efficient waveguide systems and better modeling of real-world applications of waveguides.
https://symposium.foragerone.com/2024-racas/presentations/65378

Optimization & Art: Linear Programming Formulation for LEGO Portraits
Gabriel Elftman-Hanson, *Tech, Engineering, & Math*
Mentor: Emily Speakman

Abstract:
Combinatorial optimization is a powerful modeling and problem-solving tool used in many real-world applications to determine the best (or "optimal") choice from a discrete set of possible options. However, the techniques used can also be applied in a more creative capacity: optimization art. In this poster, we explore this intersection of mathematics and art utilizing Python via Jupyter Notebook (open source) and the well-known optimization solver Gurobi.
Many well-known examples of optimization art were popularized by Dr. Robert Bosch of Oberlin College. His 2019 book, "Opt Art", presents an overview of the key techniques. The goal of this project was to develop these optimization methods and apply them to new artistic applications. That is, for our chosen image, we ask what is the best way to reconstruct it using a given LEGO portrait set, i.e., we are restricted to a fixed size and color allotment of the tiles.
To accomplish this, we began by studying a previous Python implementation of artwork construction methods. However, to solve the problem of interest, these techniques had to be expanded because our chosen method requires a more complex optimization approach. In particular, our work uses a linear programming formulation to model the problem of LEGO artwork construction.
After identifying the correct mathematical formulation, we modeled the LEGO problem in Jupyter Notebook and utilized the Gurobi solver to determine the optimal solution. We then wrote a program that tiles an image based on this optimal solution to produce a LEGO version of the original image. In this poster, we present our findings by explaining the mathematics used, breaking down our code, and showcasing examples of the LEGO artwork produced.
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Oral Microbiomes Across Genders and Ages
Daniel Skhisov, *Biomedical Sciences, Natural & Physical Sciences*
Mentor: Yue Wang

Abstract:
A microbiome is an ecosystem of bacterium that work with our body to maintain homeostasis. Every surface of our body has a microbiome. The oral microbiome plays a key role in digestion, oral health, systemic health, etc. Some key bacterium within the oral microbiome are streptococcus mitis and Neisseria flavescens. These bacterium play important roles in maintaining oral health, however if they become too prevalent, or invade into other areas of the body they can wreak havoc. Thus, it is important to see oral microbiome trends across certain meta-data points (sex and age) so that researchers can better understand what may affect oral microbiome compositions.
Utilizing a set of curated human microbiome data inputted into R and RStudio certain trends were presented in oral microbiome composition. R and RStudio are biostatistical coding systems used to analyze and present data. The average bacterium composition of subject oral microbiomes were compared against metadata points to display data trends. Using R and RStudio it was found that between the male and female sex there is

no discernable difference in oral microbiome composition. Across ages (10 years old, 15 years old, 20-65 years old, 65+ years old) it was found that there was a small, visible shift in oral microbiome composition as subjects ages.

Future directions may take larger sample sizes in order to create more concrete correlations between age and oral microbiome composition. Additionally, it may be interesting to study the metadata of oral microbiomes from different international communities to understand how regional diet may affect the oral microbiome.

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Oxidative Stress Compounds Inhibit Insulin Secretion

Isaiah Lowe, Katie Schultz, *Biomedical Sciences*
Mentor: Jefferson Knight

Abstract:
In Type 1 Diabetes (T1D), inflammatory immune cells release cytokines and reactive aldehydes that target pancreatic islets, resulting in the overproduction of reactive oxygen species (ROS) and the eventual death of the β-cells that normally produce insulin. Due to a lack of key antioxidant enzymes, β-cells are especially prone to protein oxidative damage caused by ROS and reactive aldehydes. It is known that proteins become covalently modified during oxidative stress, but which proteins are targeted in β-cells during early T1D and the effects of this protein damage on insulin secretion are poorly understood. In order to probe the connection between oxidative stress, protein damage, and insulin secretion, our lab has induced oxidative stress in insulin-secreting cell lines by treating them with either pro-inflammatory cytokines or the reactive aldehyde species 4-hydroxynonenal (4HNE). We conducted Enzyme-Linked Immunosorbent Assays (ELISA) to measure insulin secretion in these cells, and we counted individual secretion events in real time using fluorescence microscopy of cultured cells. From both ELISA and microscopy data, we observe that 4HNE inhibits insulin secretion within 5 minutes, to baseline levels as low as that of unstimulated cells. It is also known that treating β-cells with cytokines for >24h leads to oxidative damage. To compare the profiles of damaged proteins between these two models of oxidative stress, we used Mass Spectrometry (MS) to detect and identify modified proteins from 4HNE- and cytokine-treated β-cells. We found that the two treatments lead to different sets of proteins becoming modified, with some overlap between the two sets. Finally, we analyzed modified proteins from pancreatic islets of non-obese diabetic (NOD) mice, from which we observed a combination of the sets of proteins observed in the cytokine-treated and 4HNE-treated cells. These findings suggest that multiple stressors contribute to oxidative damage in early T1D and offer important insight into how these complex stresses inhibit insulin secretion.

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POKY DOCK: A Multidimensional Approach to Computer-Aided Drug Design

Mikayla Truong, *Biomedical Sciences*
Mentor: Woonghee Lee

Abstract:
In-silico screening, or the use of computational models for drug development, has dramatically increased due to the time and cost-efficient nature of the method compared to traditional laboratory experiments. An important aspect of this method is the use of ligand-based quantitative structure-activity relationship (QSAR) methods, which can predict the biological effect of chemical compounds through the analysis of their binding to target proteins. Nuclear magnetic resonance (NMR) titration is a major tool used in QSAR due to its ability to effectively produce and screen drug candidates by identifying weak-binding compounds and potential binding sites of ligands on a target protein through the analysis of chemical-shift changes in response to ligand titration. Our group has developed POKY, a software suite for multidimensional NMR analysis that integrates an in-silico screening program, POKY-DOCK, for drug design. POKY-DOCK computationally predicts how small molecule ligands bind to target proteins. We aim to advance this program by integrating herbal medicine compound libraries from Asian countries such as Korea and Vietnam. This would allow users to screen for

potential drug-like inhibitors that could bind to specified receptor proteins within these databases. POKY-DOCK will analyze the binding capabilities of a receptor with multiple ligands, creating an efficient in-silico screening tool. Additionally, POKY incorporates ASIMA (Advanced Software for Interactive Metabolite Analysis), which performs metabolite identification on multidimensional NMR data. By combining POKY-DOCK, ASIMA, and other NMR analysis capabilities within POKY such as AI-based receptor structure modeling and binding site identification capabilities, we are developing a software suite that provides a more complete picture of NMR data by identifying potential lead compounds, analyzing their binding interactions, and characterizing their metabolic profiles. As a result, this comprehensive tool would streamline the process of drug development by aiding and accelerating various stages of the drug discovery process.
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Proposed Research: Using Herbivores as Biomonitors of Heavy Metals near Superfund Sites in Denver, CO.

Christine Garza, *Natural & Physical Sciences*
Mentor: Christy Briles

Abstract:
Hundreds of superfund sites exist across the United States posing threats to human and environmental health. Superfund sites usually consist of chemical, radioactive, or heavy metal contaminants that can lead to health problems like respiratory issues, neurological disorders, organ damage, reproductive health problems, and cancer. Using superfund sites in the Denver Co metropolitan area, we present the project development of a study that examines heavy metal excretion in animal feces. The current area of focus is the Rocky Flats National Wildlife Refuge, a nuclear waste site. Control sites will consist of locations away from Superfund sites to compare. The main objective is to determine the levels of heavy metals in the environment. The study population will consist of rabbits (Sylvilagus floridanus), due to various human-animal diseases within fecal material. An ED-XRF analyzer will be used to determine the heavy metal concentration of each sample. High levels of plutonium and uranium will be sent out using the ICP for analysis of heavy metal and trace. This is one of the few studies using animal feces to examine levels of heavy metals in the environment using excrement.
https://symposium.foragerone.com/2024-racas/presentations/65516

Psychedelic Neuroaesthetics: A review and commentary on neuroaesthetics research and the relationship to the emerging field of psychedelic science.

Emily Gyongyosi, Jake Hooper, Kyle Wolfe, *Biomedical Sciences, Natural & Physical Sciences*
Mentor: Kent Hutchison

Abstract:
Neuroaesthetics is a subdiscipline within cognitive neuroscience dedicated to uncovering the biological mechanisms of aesthetic experiences. These experiences encompass perceptions and evaluations of natural objects, artwork, and environments, whose instances are ubiquitous in our daily lives. Empirical research demonstrates that aesthetic experiences arise from an interplay of sensory, emotion, and semantic neural systems. Positioned at a pivotal juncture in its history, neuroaesthetics is becoming a mainstream scientific pursuit just as psychedelic research begins to experience its renaissance. While there is growing research into the neural substrate of aesthetic experience, there has been comparatively limited exploration into the aesthetic qualities of the psychedelic experience. As the central goal of this article, we aim to justify the establishment of a new subfield in cognitive neuroscience: psychedelic neuroaesthetics. To achieve this, we first describe the role of aesthetics and neuroaesthetics, then outline the dual process of perception and evaluation. Next, we discuss psychedelics and their unique action in this process. Finally, we combine each domain and discuss the potential of future research in such a subdiscipline.
https://symposium.foragerone.com/2024-racas/presentations/65456

Pupillary responses during visual tasks assessing attention and inhibition
Bradley Stewart, *Social Sciences & Humanities*
Mentor: Dr. Carly Leonard

Abstract:
All of us are intimately familiar with our own cognitive processes that are variable and capable of extreme flexibility. Accordingly, previous research has shown variability in pupil size occurs during cognitive tasks as well (Wang et al., 2015; Joshi & Gold, 2020). The study at hand aims to look at how different cognitive processes influence pupil size. To observe this, we looked at two different tasks that measure attention and inhibition.
The first task, the stop signal saccade task, tests the ability to inhibit eye movements when an unexpected stop signal appears. It has been observed that reaction time may depend on pupil size prior to trial start (Wang et al., 2015), suggesting inhibitory signals may be less successful if the pupil is dilated at the beginning of the trial before target onset. This will be tested by examining how pre-trial pupil size influences trial success or failure during the stop signal task. The second task, the useful field of view task (UFOV), examines the broadening of attention by requiring focus on a center object while simultaneously searching for a target in peripheral vision. Attentional breadth has previously been associated with pupil size as the pupil has been observed to dilate when looking at a wider range of stimuli (Kolnes et al., 2024). The analysis will be observing pretrial pupil size and see if it correlates with success of the experimental trial. The proposed analysis stands to observe the body's reaction to cognitive activation by observing the pupillary reflex, as well as understand how pupillary state influences subsequent task performance.
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Racial and Ethnic Variations in Allostatic Load: Unraveling the Hispanic Health Paradox
William Navarrete Moreno, *Biomedical Sciences, Social Sciences & Humanities*
Mentor: Frank Degruy, MD and Sarah Staron, MPA

Abstract:
This study aims to elucidate the mechanisms underlying the Hispanic Health Paradox by quantitatively assessing allostatic load disparities among racial and ethnic groups within a longitudinal cohort framework. The concept of allostatic load serves as a multifaceted biomarker for physiological dysregulation due to chronic stress exposure, offering insights into the epidemiological enigma of Hispanic populations displaying superior health outcomes relative to their socioeconomic status.

Methods: Data were derived from the All of Us Research Program's 2019 cohort, encompassing 5,102 participants. Allostatic load was operationalized through a composite index incorporating biomarkers such as systolic and diastolic blood pressures, heart rate, body mass index, and serum levels of glucose, creatinine, alkaline phosphatase, leukocytes, urea nitrogen, and albumin. The quartile method was employed to assign allostatic scores to each biomarker, with higher quartiles indicating greater risk. Missing values were systematically excluded to maintain data integrity. Statistical analyses included two-tailed t-tests and multiple linear regression models, adjusting for potential confounders like age and gender.

Results: Findings revealed significant racial disparities in allostatic load, with Hispanic participants exhibiting a notably lower mean allostatic load (M = 6.354, SD = 1.14, pThe study substantiates the Hispanic Health Paradox and emphasizes the need for comprehensive investigations into the social, genetic, and environmental mediators that mitigate allostatic load among Hispanics. The minimal variance explained by the regression model suggests the presence of other significant determinants not captured in this study, warranting further exploration into the biopsychosocial factors influencing health disparities.
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Radicalization, Misogyny, and Violence: An Examination of the Incel Subculture in Online Communities
Michelle Vasquez Loya, *Social Sciences & Humanities*
Mentor: Dr. Melissa Tackett-Gibson

Abstract:
This research project explores the intersection between misogyny and the incel subculture, focusing on how online communities perpetuate and encourage violence against others. Individuals, such as incels, can comfortably participate in conversations that express deep misogynistic beliefs on platforms such as Reddit, which offer a degree of anonymity. Through qualitative content analysis of online incel communities, this study examines expressions of misogyny and negative attitudes toward women, identifying themes related to toxic masculinity, violence, mental health, and the formation of identity within the subculture. The analysis also considers the role of online communities in shaping incels' beliefs, contributing to a broader understanding of the incel subculture and its societal impact.
The study is also formulating a survey, with plans to begin pretesting in the next months. Building on the initial content analysis, this research project will use the survey to further explore incel ideology and behavior. The survey aims to provide insight into men's attitudes towards women and other extremist ideologies. By combining content analysis with survey data, the study seeks to understand the initial stages of radicalization experienced by men within the incel subculture. The results will contribute to a deeper understanding of the factors influencing radicalization and extremism among certain groups, with potential implications for prevention and intervention efforts. In collaboration with a student programmer data will be stripped from online Reddit forums for analysis in the summer. Through these efforts, the research aims to gain a better understanding of how radicalization is present within online communities.
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Reactivity of PNPase towards oxidized RNA containing 7,8-dihydro-8oxoguanine
Brody Reynolds, *Biomedical Sciences, Natural & Physical Sciences*
Mentor: Dr. Marino Resendiz

Abstract:
Reactive oxygen species can be generated in biological systems through regular metabolic processing of oxygen; and have a role in the development/progression of several diseases, as well as aging. Guanine in RNA can be oxidized at the C8 position and give rise to 7,8-dihydro-8-oxoguanine (8-oxoG), which is commonly used as a biomarker of oxidative stress. Polynucleotide Phosphorylase (PNPase) is an endogenous exoribonuclease that specifically degrades oxidized RNA by successive digestion from the 3' end. However, recent evidence in our laboratory indicates that the enzyme stalls at sites where an 8-oxoG is present. We set out to explore the effects of pH, divalent metal cation concentration, and sequence context, on this phenomenon. Oligonucleotides of RNA were obtained through solid phase synthesis, ^{32}P radiolabeled at the 5'-position, and treated with PNPase under various conditions. Product distribution was then carried out via electrophoretic analysis (20% dPAGE). We used 17-nt long strands of RNA as a model; sequence: 5'-CAU GAA ACA AGG XXA GU-3' (G = G or 8-oxoG, X = A,G,C,U). Interestingly, decreasing the pH or [Mg^{2+}] led to increased stalling activity and sequence context did not induce a significant change. Further research into the implications of 8-oxoG causing stalling in PNPase is underway.
https://symposium.foragerone.com/2024-racas/presentations/65467

Red Plump Tomatoes
Nicholas Wilson, Jackson Gould, *Arts & Media*
Mentor: Hans Rosenwinkel & Andrew Bateman

Abstract:
Our goal was to develop new and original ideas, reinforce the learning from our program, and push societal norms in a positive direction. Our aim was to create a piece of engaging and relatable media for young adults

that addresses feelings of insecurity, insignificance, or worthlessness and drive them to find meaningful and healthy solutions for dealing with these emotions.

Our narrative centers around a repeat college student who is feeling insecure in his relationship with a younger significant other, who is the more successful and reliant of the two. We discuss the importance of having a safe space for dialogue in the home, creating a comfortable and mutually respectful sexual dynamic, and spending quality time with one another. Alongside addressing the significance of physical exercise and therapy as means of developing good mental health. I am proud to say we cover a wide range of aspects of a relationship, while focusing on the individual's journey of developing understanding and acceptance of their place in the world, in a short amount of time. We were also able to provide over 30 people with the opportunity to develop and hone their skills throughout this production.

In order to stand out we felt it was necessary to step outside of our comfort zones and push the boundaries in all aspects of production. We will use our EuRACA grant to distribute the film to festivals to share our message and the work being done at the CU Denver Film & Television program. Through months of planning, long days of filming, and many hours at the editing bay, my entire production crew and I have developed a product we believe to be representative of the quality of work the University can be proud of. A piece of media that can make someone's life better.
https://symposium.foragerone.com/2024-racas/presentations/65514

Retention and Persistence of Physics Students at CU Denver from 2013-2023: What is a cohort?
Melissa Barru, *Natural & Physical Sciences*
Mentor: Dr. Michael "Bodhi" Rogers

Abstract:
An influx of new students and faculty members to the CU Denver Physics Department and a split from the Metro State University Physics Department over the past decade have come along with significant changes in how the success of the program is defined. The largely non-traditional student population here at CU Denver does not tend to follow the same patterns of other undergraduate only physics programs. This has prevented the department from clearly defining what a cohort of students looks like as well as knowing when it was formed. Cohorts are a readily identifiable group of students at similar points along their degree paths. This research attempts to find if and when cohorts form in the physics program, discover if there are correlations between cohorts and students graduating from CU Denver with a degree in physics and possibly identify any places along the degree path that may impact the retention of physics majors. Analyzing the initial data indicates that most students who do not graduate with a degree in physics are majors for less than 5 semesters which may not be enough time to leave the introductory curriculum and enter the higher-level physics classes. My research looks at de-identified student data including student's major, graduation status and if the student took physics or math classes here at CU Denver. Further analysis of the data using the programming language R in Google Colab notebooks should help to answer the question of when a cohort does or does form and what the path to graduation looks like for students in terms of the classes they took.
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Rhetoric of Abortion Criminalization: How Abortion Bans Utilize and Reify Cultural Narrative Archetypes
Sophia Navarre, *Arts & Media, Social Sciences & Humanities*
Mentor: Dr. Lisa B. Keränen

Abstract:
Following the overturning of the protections guaranteed by *Roe v. Wade*, abortion rights have diminished in the United States. Consequences for seeking and accessing abortions vary across state lines, and public discourse has enhanced fear and confusion around reproductive healthcare and created a reproductive health climate saturated in uncertainty. This paper uses critical rhetorical analysis to analyze the constitutive communicative nature of abortion legislation. More specifically, drawing on a theoretical insight from symbolic

interactionism, the narrative paradigm, constitutive rhetoric, and biopower, it offers a case study of the rhetoric and lived consequences of an abortion ban in Tennessee. By juxtaposing the rhetoric of Tennessee Senate Bill No. 1257, "The Human Life Protection Act," with the public scapegoating of a woman and a physician following life-threatening medical emergencies, it tracks how abortion legislation both draws from and reinforces cultural narratives and identity archetypes about criminals, motherhood, and physicians. As abortion is more frequently prohibited through legislation, its accompanying rhetorics seek to criminalize those who seek abortions and those who provide them. This case affords the opportunity to analyze current legislative rhetoric and its embodied consequences, identifying constitutive communication and strategic narratives in practice. Lastly, the paper's discussion speculates on the creative power of cultural narrative—and how we all might use communication to design narratives that empower, rather than oppress.
https://symposium.foragerone.com/2024-racas/presentations/65433

Sex Differences in a Heart Failure Caused by Titin Mutation
Maydha Kumar, *Biomedical Sciences*
Mentor: Brisa Peña

Abstract:
Heart failure is the leading cause of death worldwide [1]. Dilated cardiomyopathy (DCM) is one of the most common forms of heart failure, characterized by left ventricular dilation and contractile dysfunction [2] . Genetically, roughly 20% of DCM cases are caused by gene truncations to the protein titin (TTN) which is involved with muscle contraction and elasticity. Women presenting with DCM with the TTN mutation are less likely to develop disease symptoms, have better systolic function, and have low rates of atrial fibrillation compared to men [3]. These comparatively better symptoms could be a cause for the late diagnosis of women with heart failure. Furthermore, Women with TTN mutations are more likely to get DCM shortly before, during, or after giving birth (peripartum). Despite sex differences being known, there is less representation of women in epidemiology studies of DCM[4]. Heart failure, and specifically DCM caused by TTN truncation, is known to impact sexes differently, but both sexes are given the same treatments [5], [6]. To allow future research to create sex-specific or sex-inclusive diagnosis and treatment of TTN truncated DCM, there is a need to determine pathophysiology of the mutation on the tissue level. To begin analysis, heart tissue will be analyzed to determine if the mutation caused a tissue level measurable difference. Human heart samples will be collected from a TOPMED databank (with ~700 hearts), where small portions were sectioned. Heart sections were then stained with H&E to confirm correct tissue isolation and view basic structures, followed by Masson Trichrome to determine muscle vs collagen deposition. Representative samples will then be sent for atomic force microscopy (AFM) to examine stiffness. Finally, all images generated from stains and microscopy will be analyzed via digital image processing to create a standardization for image analysis and quantify data from the image.
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Silicon Valley Philosophies: Analyzing The Rise of AI as an Existential Risk in Global Media
Mirakle Wright, *Social Sciences & Humanities, Tech, Engineering, & Math*
Mentor: Dr.Jasmina Tacheva

Abstract:
In recent years, the idea of AI as an existential risk has become increasingly prevalent in the media. This research aims to track that trend, and critically analyze the idea of AI as an existential risk. Existential fears around AI can cause us to ignore the present harms that AI has already enacted, particularly against marginalized groups. This research is crucial for understanding proponents of this narrative and their impact on the public perception of AI. Using the emerging field of Critical AI as a theoretical basis, this research focuses on Timnit Gebru and Émile P. Torres' emerging work explaining the set of philosophies that inform the conversations around AI as an existential risk. These philosophies are Transhumanism, Extropiansim, Singularitarianism, Cosmism, Rationalism, Effective Altruism and Longtermism (TESCREAL). Using a combination of computational analysis techniques and natural language processing (NLP) tools, namely,

Named Entity Recognition, Topic Modeling and Sentiment Analysis, we analyze the trends and topics associated with AI as an existential risk in global English language news coverage. In conjunction with Gebru and Torres' analytical framework, our research revealed a clear influential presence of the TESCREAL philosophies in the global media coverage of AI as an existential risk. Future directions of this research includes analyzing the impact that this narrative has on AI policy and regulation decisions
https://symposium.foragerone.com/2024-racas/presentations/65496

Smell & memory in Alzheimer's Disease and treatment with light.
Sarah Fillingim, *Biomedical Sciences*
Mentor: Joseph Villanueva, PhD.

Abstract:
According to the Alzheimer's Association (2024), Alzheimer's disease (AD) affects almost 7 million people in the U.S. Auto-generated gamma frequency oscillations within the brain are essential to learning, memory storage, and memory retrieval, and are shown to be diminished in AD. This is due to the deposition of amyloid beta (Aβ) plaques and tau tangles in the brain and can present in the early stages as a decreased sense of smell. The inability to generate gamma frequencies in the circuitry used to fire neurons associated with smell can lead to loss of signaling and decreased neuronal activation. This loss of neurons can lead to increased cognitive decline. By inducing gamma frequency oscillations on multiple sensory systems, microglia can become activated to alleviate the progression of Aβ plaque buildup. We are using 5XFAD transgenic mice in a treatment that entrains gamma underneath theta frequencies induced optogenetically to quantify, and gain a better understanding of, microglia and T-cell activation changes to surrounding cell signaling in alleviating the Aβ and tau tangle accumulation.
https://symposium.foragerone.com/2024-racas/presentations/65508

Spending time in nature as a health behavior for college students: The role of social interaction
Madalyn Jecker, *Social Sciences & Humanities*
Mentor: Dr. Krista Ranby

Abstract:
Extensive evidence connects time in nature with wide-ranging health and wellness benefits. Likewise, substantial research has been devoted to linking social relationships to improved mental and physical health. Little is known, however, about with whom people are spending time in nature and what implications this social context has on health-related outcomes. Some data indicates that social relationships influence college students' health behaviors. Equally significant is the increased amount of time college students spend indoors, thereby missing out on the health benefits of nature. Gaining a deeper understanding of these relationships could be crucial for college students grappling with these health-compromising factors.
University of Colorado Denver students (n = 285) completed a 7-day daily diary about their time and experiences spent in nature each day. Participants are sent a link to a survey that prompts them to log their daily interactions with nature, stress levels, physical health, and affect.
Analyses will include descriptive statistics to understand the amount of time CU students are spending in nature, what types of natural environments they are in, with whom they are out in nature, as well as demographic characteristics of the participants. We will also include correlations between the amount of time spent in nature with metrics of well-being (i.e., affect and self-rated health).
As we already know, spending time in nature is a protective health behavior, and integrating this data will provide us with valuable information on CU Denver students' health.
https://symposium.foragerone.com/2024-racas/presentations/65464

Spread of Tau Phosphorylation within the Locus Coeruleus of Down Syndrome and Alzheimer's Disease.
Jenna Banh, *Biomedical Sciences*
Mentor: Aurelie Ledreux

Abstract:
Alzheimer's Disease (AD) is a neurodegenerative disorder that is clinically characterized by an impairment in memory, cognition, and motor skills. In the brain, AD is hallmarked by the phosphorylated tau (pTau) and amyloid beta, leading to the formation of intracellular neurofibrillary tangles, and extracellular amyloid plaques that culminate in the cognitive impairment observed clinically. Individuals with Down Syndrome (DS), or Trisomy 21, have a significantly increased incidence of AD, due to the additional copy of amyloid precursor protein found on their triplicated chromosome 21. The locus coeruleus (LC), is a small nucleus within the pons region of the brain that produces the neurotransmitter norepinephrine throughout the central nervous system. The LC is responsible for modulating key aspects of behavior, such as attention, motivation, and stress response. In AD, this region has appeared to be one of the earlier sites to accumulate p-Tau, which causes dysregulation of NE throughout the brain. The mechanisms by which toxic forms of p-tau and amyloid-beta spread from the LC to other parts of the brain is not well understood in individuals with AD and DS-AD. To explore this, we used the Ts65Dn mouse model of DS, which is characterized by three genetic copies of chromosome 16, which are similar to human chromosome 21. Male Ts65Dn mice and their normosmic control litter mates were unilaterally injected in the LC, with either neuron-derived extracellular vesicles (NDEVs) isolated from the plasma of individuals with DS or from healthy controls. Behavioral tests, such as novel object recognition, were used to identify potential learning deficits caused by memory impairment. Immunofluorescence staining of mouse brain sections of the brain section of the LC was conducted to examine the loss of NE neurons, as well as the presence of p-tau and neuroinflammation. Preliminary results from immunofluorescence suggest that mice injected with DS-NDEs express early indications of AD-like tau phosphorylation. These data can provide a better understanding of the mechanisms by which AD pathology spreads from the LC to other parts of the brain in DS-AD.
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Study of 1,4-Dioxane Co-Metabolic Degrading Bacteria, Degradation and Possible Alternative Substrates
Lucas Thornton, *Natural & Physical Sciences*
Mentor:

Abstract:
The co-metabolic degradation of 1,4-dioxane has been a promising strategy for the remediation of contaminated sites, such as the Lowry Landfill Site in Aurora, Colorado, which is currently dealing with contamination by 1,4-dioxane and tetrahydrofuran (THF) contamination. The scope of my research investigates the potential for co-metabolic degradation of 1,4-dioxane, focusing on the utilization of THF as a co-substrate, and explores additional substrates to enhance degradation efficiency. Experimental approaches involve enrichment cultures derived from environmental samples collected from the Lowry Landfill Site, while implementing media conditions optimized to mimic site conditions. Substrates including THF, ethanol, acetone, and cyclohexane are supplemented to assess their effectiveness in promoting co-metabolic degradation pathways. Growth conditions (e.g. temp, substrate concentrations, co-occurring nutrients, etc) are tailored to stimulate microbial activity conducive to 1,4-dioxane degradation. 16S rRNA gene sequencing will be utilized to characterize and categorize bacteria communities in the cultures and identify potential degraders capable of co-metabolic degradation, e.g *Pseudonocardia dioxanivorans*. and *Pseudonarcodia tetrahydrofuranoxydans* K1. By examining the metabolic potential of these communities, insights are gained into the pathways involved in 1,4-dioxane degradation and the factors influencing substrate use. The research focuses on the significance of the Lowry Landfill Site as a study for understanding the challenges and opportunities related with co-metabolic degradation of 1,4-dioxane in large contaminated environments. The identification of THF and other substrates as effective co-metabolic substrates shows the potential for improving degradation rates and expanding the range of microbial degraders. Future research directions include the isolation and characterization of novel degraders from the enriched communities, discovery of any other potential substrates, and an understanding of these metabolic pathways. These efforts show great promise for the development of given bioremediation strategies targeting 1,4-dioxane contamination.
https://symposium.foragerone.com/2024-racas/presentations/65445

Targeting and increasing anti-tumor response in low-affinity T-cells using a synthetic virus
Jaydeen Tochi Merur, *Biomedical Sciences*
Mentor: Jill E. Slansky

Abstract:
When a body is ailing with cancer, the immune system helps defend the host and kill the cancer cells with a kind of white blood cell known as T cells. These cells contain receptors known as T cell receptors (TCR), which bind to many antigens made of different peptide/MHC complexes. The strength of the interaction between TCR and peptide/MHC ligand, referred to as affinity, directly affects the T cell functions. The function of the T cells we study is to attack the cancer that is invading the body. As follows, TCR with low affinity for tumor antigen do not have high responsiveness. We are using a CRISPR-Cas9 platform to engineer T cells with low-affinity for antigen to knock out genes that suppress the T cells from undergoing cell division. The CRISPR-Cas9 is introduced to the T cells via a synthetic virus we subcloned. Our hypothesis is that knocking out such genes will increase anti-tumor responses from the T cells. Thus far, we have successfully synthesized a usable virus that will allow entry of the CRISPR-Cas9. Our hope is that using this method we can knock out our genes of interest, BTG1 and BTG2, which inhibit cells from proliferating. We obtained promising results with a pilot virus that targeted CD90/Thy1, an easily detected control gene. We are currently attempting to reproduce such knockouts of the BTG1 and BTG2 genes, which will be followed by examining the altered function of the T cells.
https://symposium.foragerone.com/2024-racas/presentations/65616

TASTE OF DISPLACEMENT: Bengali Culinary Narratives in the Aftermath of the Partition of 1947
Indira Saha, *Social Sciences & Humanities*
Mentor: Steven M. Vose

Abstract:
When we delve into the history of the Indian subcontinent, the partition of India is associated with insurmountable loss and massive migration upheaval. People were separated not according to their shared lifestyles, food habits, music, or even language; it was religious identity that decided the fate of many families back in 1947. As millions migrated in search of safe territories, did they lose their ethnic identity? Was cultural disintegration a primary consequence of such a large-scale exodus? Finally, did the South Asian populace embrace their old identities in a foreign land?
The refugees survived those dreadful days and built a new life in the following years. What remained were remnants of the past. Food rituals, delicious recipes, distinctive dressing styles, festivals, kitchen calendars, and other material remains were the only baggage these refugees had in their new homes. Even though they shared the agony of losing their identity and homeland *(Ghare)*, they had attempted to re-establish some of the long-standing rituals in their new lives in the foreign country *(Baire)*, which was now their own.
This study aims to delve into the stories and experiences of the Bengali community during the tumult left in the wake of the partition, focusing on how they navigated the challenges of displacement and resettlement. By examining these narratives, I would explore how the political divisions shaped and redefined the culinary landscape of Bengal. Through a comprehensive analysis of historical accounts and personal narratives, this study will highlight the ways in which food became a powerful tool for cultural preservation, adaptation, and identity formation in the face of significant societal changes post-1947.
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Testing Bio engineering potentials of protein Lactoferrin in potential biological applications.
kasun wanasinghe, *Biomedical Sciences, Natural & Physical Sciences*
Mentor: Dr Erik Oleson

Abstract:
Testing how Lactoferrin could be incorporated into household products such as soaps or detergents.

How incorporating Lactoferrin as the anti microbial agent instead of Formaldehydes would be much safer and economic as its physical condions to create them are low.
Formaldehydes are carcinogenic and long term exposure can make humans susceptible to cancers and replacement of Formaldehydes with Lactoferrin could decrease the risk by a huge amount.
https://symposium.foragerone.com/2024-racas/presentations/65497

The acute effects of cannabis versus oxycodone on measures of impairment
Chloe Alvarado, *Biomedical Sciences*
Mentor: Dr. Alan Morris

Abstract:
Epidemiological and clinical data suggest that cannabis might be an effective alternative to oxycodone for the treatment for chronic pain conditions. With increasing medicinal and recreational cannabis legalization, there is a public health need to understand the acute effects of cannabis on motor control. This secondary analysis of data from a randomized, double-blind, placebo-controlled, crossover study aimed to compare the acute effects of cannabis versus oxycodone versus placebo on motor skills in healthy participants.
After informed consent and screening, participants attended 3 separate 4-hour study visits, at which they received one of the following drug combinations at each visit: active vaporized cannabis containing 5.4% THC (placebo capsule), active oxycodone 5-10mg (placebo cannabis), and placebo/placebo. Participants underwent pre- and post-drug assessments such as: Subjective Participant Survey, Hopkins Verbal Learning Test Revised (HVLT-R), Grooved Pegboard Test (GPBT) and Standardized Field Sobriety Tests (SFST). These tests were used to measure of acute impairment at baseline, and 5 minutes, 1 hour, 2 hours, and 3 hours after drug administration. Descriptive statistics were performed on a subset of data collected from participants who completed all three study visits.
A total of 64 participants completed the study. Participant's cannabis survey ratings showed a rapid onset of effects including feelings of being "impaired" that diminished over time. As well as marked psychomotor impairment in GPB test performance when compared with placebo and oxycodone at all post-administration timepoints cannabis decreased. The largest deficit in GPB performance was observed 5 minutes after cannabis use, and the smallest deficit was observed 3 hours post administration. Subjective ratings align with SFST and Nystagmus results indicate a rapid onset of effects followed by a gradual decline after administration. Placebo and Oxycodone showed fewer subjective effects compared with Cannabis overall. In terms of marked psychomotor impairment HVLT-R, and subjective drug effect ratings demonstrated impairment 1 hour post drug administration and oxycodone trials showed peak impairment at the 3-hour time point,
The data presented here suggest that cannabis given acutely, negatively effects fine motor control more than oxycodone, a commonly prescribed drug for pain. This study provides initial evidence that certain doses of cannabis might impair fine motor function. This knowledge is crucial for providing informed guidance to chronic pain patients who are using cannabis as a therapeutic option, ensuring their safety and minimizing potential risks. Further research is needed to fully understand the long-term effects of cannabis on motor functions and pain in a broader population. Conducting such research is essential to ensure the safe and effective use of cannabis while simultaneously providing clinicians with evidence-based guidance for optimal patient care.
https://symposium.foragerone.com/2024-racas/presentations/65547

The Effects of Visual Competition on Stopping Eye Movements
Zachariah Weir, *Natural & Physical Sciences*
Mentor: Carly J. Leonard

Abstract:
From keeping yourself safe on the road to managing how your attention is used on social media, investigating the mechanics of eye movements is crucial for understanding human behavior in split second decisions. Our study used a stop-signal task (SST) to approximate inhibition scores for 25 participants. During "go" trials,

participants were asked to rapidly move their eyes to a target. During a small percentage of trials, referred to as “stop” trials, a stop-signal was presented slightly delayed from the target presentation. Participants were tasked with inhibiting their eye movement to the target after the presentation of the stop-signal. Using reaction time and stop-signal delay values, a stop-signal reaction time (SSRT) inhibition score was calculated for each participant. Our study investigates the influences of visual competition on SSRT scores by varying the distance between the target and stop signal (2.5 and 7.5 degree conditions). The 2.5 degree condition was predicted to have lower SSRT values and more saccadic control than the 7.5 degree condition because the increased visual competition would aid implicit stop-processes. Trials in which participants were unable to inhibit their eye movement after stop-signal presentation were also expected to have smaller amplitudes and slower velocities than successful go trials due to this stop signal interference. The results showed the predicted differences in SSRTs between eccentricity conditions and significant differences in the characteristics of saccades in terms of reduced amplitude and slower velocity on go versus failed-stop trials. These findings suggest that saccades remain susceptible to competition's influence and that visual competition significantly alters the winner of the race between stop and go processes. These findings have important implications for how the specific neural subsystems involved in generating and inhibiting eye movements interact.
https://symposium.foragerone.com/2024-racas/presentations/65505

The Impact of Contemporary Antisemitism on Jewish Identity, Presentation, and Personal Security
Leia Rockhold, *Social Sciences & Humanities*
Mentor: Keith Guzik

Abstract:
The Jewish community is well integrated into contemporary America. However, antisemitic thoughts and violence have been on the rise in the past few years, especially as the country becomes more divided concerning political and racial issues. There is little research that documents the emotions and reactions of the Jewish community and their responses to prejudice in these times. As a group that has been heavily persecuted throughout history, we wonder how they are reacting to this cultural shift in terms of the presentation of their faith and regard to plans for their safety. This research attempts to answer this question through in-depth interviews with members of the Jewish community. This project hopes to examine 3 specifics in the lives of American Jews:

- To potentially observe the hypothesized changes in Jewish religious and cultural identity in the face of antisemitism, by observing if Jewish Americans lean more into or away from their Jewish identities, and in what ways.
- To observe the comfortability of religious presentation in times of antisemitism, i.e. if religious garb and jewelry are worn more or less often, or only in a certain context and why.
- Finally, observe the reactions of Jewish Americans regarding their safety protocols for protecting themselves and their families, such as thoughts of immigration or self-defense.

In this evaluation, I hypothesize that the observed increase in antisemitism over the last decade in America has impacted the religious and cultural expressions of Jewish Americans as well as contributed to an increase in measures for protection and safety. If true, this may indicate that American Jews are beginning to view American society as unsafe, and will begin to dissimilate from it, retreating into their religious/ cultural communities for personal safety and freedom of expression without fear of harm.
https://symposium.foragerone.com/2024-racas/presentations/65542

The Impacts of Socially-Contingent Gender Roles on Perception
Ethan Kolb, *Social Sciences & Humanities*
Mentor: Carly J. Leonard

Abstract:
Cultural trends have shown us the socially-contingent nature of gender categorization and bias, which leads to real material consequences. For example, it has been shown that there is a positive relationship between economic, political, and reproductive health inequality and interpersonal violence among women, and not for men (Willie, Kershaw, 2019). In cognitive psychology studies, research has shown that gender-related socially-contingent assumptions are engrained into implicit and automatic processing. These processes often happen a few hundred milliseconds after contact during the early phases of visual perception. The goal of this literature review is to the find the effects societal gender roles have on perception and subsequent behavior. Much of the research has shown that faces with stereotypically masculine and stereotypically feminine features require less time for processing. This finding also applies to more nebulous tasks like sorting masculine names in a larger font faster than smaller font, and vice versa for feminine names, which can be interpreted as an implicit association toward masculinity and largeness (Zhang, Li, Eskine, & Zuo, 2014). Our implicit understanding of gender can have an intersectional relationship to other social categories as well, such as race and ethnicity. This can be seen in studies showing that the judgement of gender-ambiguous faces depends on their ethnic phenotype. Much of the research that was analyzed for this review included participants who were part of homogenous social groups. In the future, a more intersectional approach which includes ethnic diversity and gender non-conforming participants will be needed to better understand the visual perception of gender.
https://symposium.foragerone.com/2024-racas/presentations/65364

The measurement of expelled zooxanthellae using sensor and data fusion to predict the effect heat waves in coral reefs
Kyra Jordan, *Natural & Physical Sciences, Tech, Engineering, & Math*
Mentor: Chris Crowley

Abstract:
The measurement of expelled zooxanthellae using sensor and data fusion to predict the effect heat waves in coral reefs
In the last half century the area coral reefs cover has fallen nearly to 50 percent. Due to the warming oceans, changes in the halocline, runoff, oil spills, ect, these essential reefs are slowly dying. They are the face of economic success in shoreline communities across the world, and produce 375 billion dollars in product and services annually. In the medical industries half of all Cancer drug research is focused on marine organisms, many of which are found and are
dependent on healthy coral reefs. Our current data collection methods and monitoring of these reefs(Satellite, Ariel Imaging, and Individual divers) are slow, expensive, outdated, and often don't provide detailed enough information about individual reefs. To provide more information about the changes occurring in the reefs, by predicting heat waves and identifying environmental
hazards before they become disasters, my project will help scientists prepare and protect these reefs. My project is stored in a waterproof housing for periods of time collecting data on the water's; salinity, turbidity, and temperature. Using both sensor fusion and weather data sets, I plan to create a monitoring system for individual reefs. I expect at the end of this project to have both raw data in a database and a collection of graphs built into my project, making the data easy to access and understand. In the collection of data I will use many methods, the first is the initial dry testing and running of the code. The project was be tested through simulations of different bleaching scenarios, as proof of concept by using established saltwater tanks.
https://symposium.foragerone.com/2024-racas/presentations/65454

The NarK Antiporter from *E. coli*: A QM/MM Study
Natalie Schultz, *Natural & Physical Sciences*
Mentor: Dr. Hai Lin

Abstract:
The essentiality of nitrogen in its mineral form to various organisms is well documented. Many organisms will intake nitrogenous compounds in the form of nitrate ions and export the waste metabolite nitrite out of their cells.[1,2] One critical protein involved in this process is NarK. Here, we present a QM/MM study of the NarK antiporter from E. coli. We analyze the interactions between the anions and key binding-site residues in the pore.[3] Our results provide a possible explanation for the striking experimental finding that the charge-preserving arginine-to-lysine mutation impedes or abolishes anion transport in such mutants of NarK and other similar nitrate/nitrite exchangers.
https://symposium.foragerone.com/2024-racas/presentations/65394

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

Abstract:
CD8 T cells play an essential role in the prevention and controlling of infections and tumor development/progression. However, a timely and quality immune response depends on the cell's ability to find and reach target sites. This makes CD8 T cell migration especially important because it determines how quickly these cells migrate and kill infectious cells. In addition, once CD8 cells get into a tumor, CD8 cells also need motility (random walk) and fitness to be able to find their targets. Thus, we propose that by increasing the motility of effector CD8 cells in the presence of IL-2 and IL-21 (cytokines), we will be able to enhance their ability to find and kill specific target cells including infectious tissues and solid tumors.

When CD8 effector cells are expanded with IL-2 they proliferate and survive very well but have minimal capacity to move which can impact anti-tumor immune responses. Our recent studies have revealed that effector CD8 cells expanded with IL-2 and IL-21 display a superior motility (faster and/or longer) than CD8 cells with only IL-2. We have also obtained data showing that the effect of IL-21 on CD8 cell motility is by improving mitochondrial metabolism and mitochondrial calcium as tested through intracellular staining, flow cytometry and verified via quantification of cell concentration. We also found that the presence of both IL-2 and IL-21 results in a superior killing efficacy of B16 (cancer) cells. This is highly impactful, especially for the potential improvement of T cell therapies against solid cancers.
https://symposium.foragerone.com/2024-racas/presentations/65457

The TotalSegmentator Artificial intelligence tool is totally awesome at automatic organ modeling.
Brendan Hinckley, Abby Wohlfert, *Biomedical Sciences, Tech, Engineering, & Math*
Mentor: Dr. Ernesto Salcedo

Abstract:
The best way to teach human gross anatomy combines cadaver-based instruction with multimedia tools, 3D models, and interactive products. Advances in biomedical 3D modeling and advanced image processing have made generating such resources increasingly accessible. For example, cadavers can be scanned using computed tomography (CT) and the resultant 3D images explored using open-source visualization software, such as 3D Slicer (https://www.slicer.org). Such software can generate 3D model renders of bodily structures, allowing students to see the internal organization of the cadaver. Historically, bones and lungs have been amenable to automated segmentation due to their high radiometric contrast in comparison to the surrounding tissue. Organs, such as the kidney or liver, typically have poor radiometric contrast and often require manual, time-consuming segmentation to create 3D renders. Manual segmentation of all organs within cadavers has been prohibitively time-consuming, thus diminishing the usefulness of cadaveric CT scans as a dissection resource. This equation has changed with machine learning tools, such as nnUnet and the TotalSegmentator deep learning segmentation model (https://totalsegmentator.com), which can automatically segment major anatomic structures in CT images. This study was designed to test the hypothesis that TotalSegmentator can

accurately segment major anatomic structures in CT images of donor cadavers. We tested this hypothesis by running the segmentation model on the CT scans of 15 donor cadavers from CU Anschutz Modern Human Anatomy program. Our results show that TotalSegmentator can accurately and consistently segment 104 organs, bones, muscles, and various soft tissues in minutes, allowing for the complete visualization of anatomical variances across donor cadavers. In fact, when we compared the automated segmentations of the liver to segmentations that we generated manually, the automated segmentations were more accurate than the manual segmentations. Leveraging 3D visualization software and machine learning is powerful tool for developing sophisticated resources for anatomical education and research.
https://symposium.foragerone.com/2024-racas/presentations/65371

THE WEAPONIZATION OF CIVILITY AND DECORUM IN LEGISLATIVE PROCESSES
Hazzel Chavira , *Social Sciences & Humanities*
Mentor: Dr. T. Robinson

Abstract:
Debates over “civility” & “decorum” in legislative processes are increasingly common in American politics. In Colorado, Montana, & Tennessee legislators targeted for alleged breaches of incivility were either legislators of color or LGBTQ+, who vigorously challenged policies causing racial or gender harm. Throughout U.S. history, socially constructed words like ‘decorum’, ‘etiquette’ & ‘civility’ have often been used against civil rights protestors and legislators of color to critique their demands and help perpetuate a racist system that maintains white privilege.

This paper hypothesizes that critiquing legislators of color for allegedly “Divisive” critiques/ behaviors is a harmful double standard that allows/ignores polarizing language/behavior by white legislators nationwide.

This paper will study the language/acts of censure/reprimands occurring in State Capitols nationwide to document:

1. *actions/behaviors* that lead to/or not official condemnations
2. *how often official condemnations (censures/reprimands) are imposed* for incivility against which Legislators

Nationwide patterns regarding points 1 and 2 (above) will be identified through a review of national press coverage of state legislatures, using databases like Newsbank.

In Tennessee the GOP-dominated House expelled two black members for roles in demonstrations circling gun control. In Montana, a trans legislator was censured/banned from the legislative floor. In Colorado, a Black legislator was censured/removed from Committee Chair role for joining a pro-Palestine protest in the gallery.

Being an intern with Colorado’s 74th General Assembly for Representative Bacon, a legislator of color, will give me unique insight into ongoing Colorado legislative debates over “decorum” & “civility” & how these debates do or do not inequitably target/harm legislators of color.

This research will allow for an informed assessment of the racialized/genderized patterns of “civility enforcement” by America’s legislative bodies whilst compiling an encyclopedic list of frequency legislators of color have been reprimanded/censured nationwide (for what) versus white/GOP legislators, since 2020.
https://symposium.foragerone.com/2024-racas/presentations/64986

Therapeutic Contact Lenses for Corneal Disease
Dien Thinh Nguyen, *Biomedical Sciences*
Mentor: Jung-Jae Lee, PhD

Abstract:
Corneal melting, a severe ocular disorder marked by the degradation of corneal tissue, poses a significant risk of vision loss and necessitates innovative treatments. A study was conducted to explore the development of therapeutic contact lenses utilizing hydrogels, aimed at mitigating matrix metalloproteinases (MMPs) activity, which is critical to the progression of corneal melting. MMPs are zinc-dependent enzymes, that play a pivotal role in the breakdown of corneal tissue. The study focuses on the synthesis of hydrogels incorporated with zinc-chelating agents, such as ethylenediaminetetraacetic acid (EDTA) and diethylenetriaminepentaacetic acid (DTPA), conjugated with poly(2-hydroxyethylmethacrylate) (pHEMA) to inhibit MMPs activity. Hydrogels with varying initiator concentrations were created to determine which achieves optimal zinc absorption—a key factor in MMP inhibition. The results indicate that hydrogels with a 75% initiator concentration exhibit the highest porosity and highest zinc absorption. This suggests that greater surface area in hydrogel can increase the ability to absorb zinc. Comparative analysis showed no statistically significant difference in the zinc absorption between EDTA and DTPA-conjugated hydrogels, suggesting similar efficacy. The potential application of these hydrogels in producing therapeutic contact lenses could significantly reduce the need for more invasive treatments and decrease healthcare costs. Furthermore, understanding and controlling MMP activity could also impact other health areas, such as tumor suppression and metastasis inhibition. Future studies will continue to refine the hydrogel formulations and assess their clinical efficacy in treating corneal melting and potentially other MMPs-related conditions.
https://symposium.foragerone.com/2024-racas/presentations/65539

TINTO in POKY for Novel Computer-Vision Based NMR Walking Strategies
Zowie Werner, *Natural & Physical Sciences*
Mentor: Dr. Woonghee Lee

Abstract:
Peak overlap and variable data quality often hamper traditional assignment methods. Addressing these challenges, we present TINTO (Two and three-dimensional Imaging for NMR sTripOperation via CV/ML), a novel toolset by computer vision-based strip matching that does not rely on cross-peaks for sequential walking on the spectrum. TINTO utilizes the Structural Similarity Index and Principal Component Analysis to perform visual similarity searches of resonances and quickly locate similar strips. We have developed two versions of TINTO within POKY: the stand-alone version of TINTO for 2D, and the integrated strip plot version of TINTO for 3D. Our benchmark results on Nsp7, Cl13, and Ubiquitin demonstrate that TINTO is a promising tool for accurate NMR assignment without the need for peak picking. TINTO is pre-installed in the POKY suite, which is available at https://poky.clas.ucdenver.edu.
https://symposium.foragerone.com/2024-racas/presentations/65412

To the Left, to the Left? Investigating the Presence of Pseudoneglect in the Useful Field of View
Kelly Karagias, *Social Sciences & Humanities*
Mentor: Carly J. Leonard

Abstract:
When driving in our cars, we constantly have to attend to our central field of view while also being able to spread attention to the periphery without taking our eyes off the road. In a laboratory setting, this type of attentional spread is measured with the Useful Field of View (UFOV) paradigm. Presently, we aimed to investigate left-right differences in a UFOV task. Previous findings have suggested a phenomenon known as pseudoneglect, in which biases in line bisection are attributed to a leftward bias in attention. Our hypothesis posits that if the leftward bias observed in pseudoneglect reflects a genuine attentional bias, it should manifest in a UFOV task as well. This study aims to deepen our understanding of attentional distribution across the visual field during complex tasks, contributing insights to the broader field of visuospatial attention research. Twenty-five University of Colorado Denver students completed a UFOV task with a single-task condition and a dual-task condition. The single-task condition consisted of locating a titled target among

vertical distractors in the periphery, with variations in distance from fixation. The Dual-task condition involved simultaneous discrimination of a central 'L' or a 'T' in addition to the peripheral task.

Our findings indicate an interaction between eccentricity and visual field side in attentional tasks, aligning with our hypothesis. Analysis revealed a significant impact of target position on central task performance, with the greatest decline observed when the target was placed in the far-left eccentricity, suggesting a predisposition of attentional resources towards the left visual field. Similarly, the relationship between task difficulty and eccentricity was statistically significant, highlighting the role of spatial positioning in attentional distribution. In the peripheral task, accuracy significantly diminished for targets positioned in the near-right, compared to the near-left condition where the highest accuracy was noted. These results demonstrate a consistent leftward bias in attentional spread across both tasks, offering support for the pseudoneglect phenomenon in visual attention tasks. The implications of these findings extend to understanding visuospatial attention distribution, especially in tasks demanding simultaneous focus on central and peripheral stimuli, such as driving.
https://symposium.foragerone.com/2024-racas/presentations/65398

Towards Realization of Novel Quantum Materials via Magneto-Synthesis
Tristan Cao, *Natural & Physical Sciences*
Mentor: Gang Cao

Abstract:
It has been widely recognized that whoever controls the development of novel materials controls technologies that evolve from them. The science and technology of materials synthesis are at the heart of the discovery, design, and realization of novel quantum materials that underpin quantum technologies. The current lack of clear-cut material realizations of many long-sought quantum materials expected to underpin novel technologies strongly suggests that daunting materials challenges will hinder advances in the development of quantum technologies, such as realistic quantum computers in future decades. There is a clear indication that existing synthesis techniques are inadequate. Left unaddressed, these urgent material challenges will hinder the advancements of revolutionary new quantum technologies. New synthesis technologies capable of producing novel materials are urgently needed. This project offers a timely response to the materials challenges by advancing the science and technology of materials fabrication in magnetic fields via magneto-synthesis. Our preliminary results indicate that magnetic fields can not only "edit" crystal structures via Lorentz forces but also produce new phases by taking advantage of the dependence of the Gibbs free energy on the applied magnetic field. Our study finds that magneto-synthesis works particularly well for quantum materials with strong spin-orbit interactions and near-degeneracies, which offers control of structural and physical properties unattainable by other means. The results along with experimental details will be presented and discussed.
https://symposium.foragerone.com/2024-racas/presentations/65294

Tradition and Ink: Exploring Contemporary South Korean Tattoo Art and Artistry
Victoria Harrison, *Arts & Media*
Mentor: Yang Wang

Abstract:
The development of contemporary tattoo art in South Korea rests at the fascinating intersection of traditional culture and social stigmatization. Due to historically entrenched negative perspectives on tattooing, little scholarship has been published on tattoo art, in particular on the subject of contemporary South Korean tattoo art. Because tattooing remains illegal in South Korea, the practice survives underground, thus further impeding research on the subject. My thesis project explores the world of tattooing in relation to South Korea and delves into the dynamic between tradition and the recent globalized phenomenon of permanent body art. Specifically, this paper will investigate the transformation of traditional cultural objects/art forms, such as the *norigae* knot or blue-and-white ceramics, from a physical object into a tattoo. I will analyze the symbolic significance of tattooing practices within the context of modern Korean society in order to see how the translation of cultural

motifs alters or renews their original meanings. Moreover, by examining South Korean artists currently working in the United States, I will address the implications of placing such imagery on individuals outside the South Korean ethnic sphere, particularly Americans or those of non-Korean descent, and how this may further reshape its interpretation and cultural connotations. I argue that many contemporary South Korean tattoo artists have developed a style that reflects a fusion of traditional imagery and the needs of the modern-day, globalized tattoo industry, thereby beginning to reshape views of a historically stigmatized art practice while also benefitting the preservation of Korean culture amid rapid progression and modernization. Despite the current legal limitations on tattooing in South Korea, this paper endeavors to contribute to the understanding of the complex interplay between traditional motifs, social stigma, and artistic expression in contemporary South Korean tattoo culture. By navigating these contours, this research aims to shed light on an underexplored aspect of modern Korean society and its evolving relationship with tattoo art.
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Translocator Protein Ligands Inhibit Neuronal Excitability in Primary Neuronal-Glial Cultures
Rebecca Han, *Biomedical Sciences*
Mentor: Dr. Manisha Patel

Abstract:
Epilepsy is one of the most common neurological diseases with nearly 5 million diagnoses yearly with symptoms that are often debilitating to patients' everyday life. Treatment outcomes are often variable, highlighting the need for novel therapies. Multi-electrode arrays (MEA) function as a high-throughput tool to evaluate neuronal activity following drug administration in a noninvasive manner that maintains structural integrity in-vitro, which is imperative in investigating potential therapeutics for epilepsy. Previous research in the laboratory reported downregulation of a key gluconeogenesis gene in a mutant zebrafish model (scn1lab) of Dravet syndrome (DS), a severe pediatric epilepsy. Further experiments showed that DS zebrafish treated with PK11195, a translocator protein (TSPO) ligand, experienced decreased electrographic seizures and rescued the metabolic deficits seen in vehicle treated mutants. TSPO is an outer mitochondrial membrane protein with numerous putative mechanisms and serves as a biomarker for neuroinflammation. TSPO ligands have been implicated in the synthesis of neurosteroids and anti-inflammatory effects leading to investigations in their effects in neuropathologies. To build upon the potential beneficial effects of TSPO ligands in epilepsy models, this experiment utilized MEA plates to screen TSPO ligands, Etifoxine and PK11195, in primary cortical neuronal-glial cells derived from embryonic rats. 4-Aminopyridine (4-AP) was used to produce dysregulated hyperexcitability, a key trait in epilepsy. 4-AP is a commonly used seizurogenic compound and works by blocking potassium ion channels and prolonging action potentials. Preliminary data show that pre-treatment with TSPO ligands, Etifoxine and PK11195, blocks 4-AP induced excitability, measured by neuronal spike and bursts. Together with their effects in the DS zebrafish model, these data suggest that TSPO ligands, Etifoxine and PK11195, may be promising therapeutics for treating drug-refractory epilepsy. The results underscore further investigation into potential mechanisms by which TSPO ligands inhibit neuronal hyperexcitability.
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TRYPTOPHAN METABOLISM CONTRIBUTES TO AUTOIMMUNE ARTHRITIS THROUGH MODULATING AUTOANTIBODY RESPONSES
Jimmy Tangchittsumran, *Biomedical Sciences*
Mentor: Dr. Kristine Kuhn

Abstract:
Tryptophan metabolism is linked to the development of autoimmunity, suggesting one of its active metabolites activates immune responses. Our own data utilizing a mouse model suggests a link between the tryptophan metabolite, indole, and autoimmune arthritis leading to the hypothesis that indole is pathogenic. The similarities in joint inflammation which develops in the mouse Collagen Induced Arthritis (CIA) model resembles inflammation in human patients. To investigate the effect of tryptophan metabolism and indole production, we devised 3 treatment groups to determine the effect/severity on inflammatory response during

CIA model. DBA mice of six to eight weeks old were used in the experiment to ensure a fully mature immune system. Mice were immunized with complete Freund's adjuvant (CFA) and collagen at day zero and day twenty-one, given formulated diets and indole, and scored for joint inflammation regularly. At day 35, serum was collected for analysis of anti-collagen autoantibody production by ELISA for anti-collagen Immunoglobulin G (IgG) and IgG isotypes (IgG1, IgG2a, and IgG 2b). Tryptophan produces indole by metabolic pathway and affects anti-CII antibodies, which then affects joint inflammation. Changing mice to a tryptophan deficient diet reduced auto-immune arthritis as C3 activation and IgG 2b was lower. Removal of indole (TD) from CIA mouse diets led to less pathology observed. The importance of this is to facilitate a better understanding which can translate to treatment for analogous human auto-immune arthritis and risk factors. This data also helps to highlight the role of diet and gut microbiota regarding those with predisposed conditions.
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Two is the Loneliest Number: Depictions of Friendship in Contemporary Western Art
Josephine Clark, *Arts & Media*
Mentor: Dr. Yang Wang

Abstract:
Romantic love has been widely depicted in art and examined by scholars; however, platonic love between friends has received scant scholarly attention, leaving a gap in our understanding of how such images embody the cultural practices and values of their societies of production. My thesis examines examples of Western European and American contemporary art that depict friendship. These depictions illustrate the educational influence such images have on certain communities, which in turn reflects the hierarchy of values in that community. To display diversity in the reaches of this value system, I address several works that vary in medium with an assortment of artists from different backgrounds. I then examine these works in greater detail, revealing their similarities and differences, then addressing where Western contemporary art falls short in depicting these values. Through comparison, the differences between depictions of platonic love and romantic love are addressed, as well as the accessibility of each. This discourse is crucial today more than ever as the United States is undergoing a loneliness epidemic, due to a lack of strong community connections. The overwhelming presence of today's loneliness epidemic reveals how the value placed on community in a given society positively impacts the mental well-being of society. I argue that artistic portrayals of friendship complicate traditional notions of love, and in the process, challenge Western capitalistic values centered on individuality. When put on display in public places, artwork illustrating platonic love then becomes an educational tool, subconsciously and consciously working to reinstall our essential human need for strong communal connections. By investigating artistic depictions of non-romantic platonic love, this project reveals the relationship between Western notions of individuality and artistic production and highlights revisionist interventions that seek to erode the focus on romantic love.
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Understanding Alzheimer's Disease at the Synaptic Level Using Mouse Models
Jami Helmig, *Biomedical Sciences*
Mentor: Mark Dell'Acqua

Abstract:
Alzheimer's disease (AD) is characterized by amyloid beta (Aβ) protein aggregates that lead to dysfunction at neuronal synapses, memory loss, and cognitive decline. Our lab is interested in the synaptic scaffolding protein A-kinase anchoring protein (AKAP) 79/150. AKAP anchors various kinases and phosphatases to regulate calcium-permeable AMPA receptor (CP-AMPAR) trafficking to control long-term potentiation (LTP) and depression (LTD) of synaptic function. Synaptic trafficking mechanisms involving CP-AMPARs remain to be fully elucidated but could contribute to Aβ induced synaptic dysfunction in AD. Preliminary findings using AKAP150 CS mutant mice, where AKAP palmitoylation is disrupted, leading to altered trafficking of the AKAP and CP-AMPARs in recycling endosomes (RE), reveal impaired LTP compared to healthy wildtype (WT) controls when induced by high-frequency stimulation (HFS) at 100 Hz issued two times, 5 minutes apart. However, LTP

deficits are not observed in CS mice when 2x100 Hz HFS is delivered only 20 seconds apart. While 2x100 Hz, 5-minute LTP in WT is acutely inhibited by Aβ or CP-AMPAR antagonists, 2x100 Hz, 20 sec LTP in WT is insensitive to both these agents. In contrast, 2x100 Hz, 20 sec LTP in CS mice is sensitive to inhibition by both Aβ and CP-AMPAR antagonists. Thus, we hypothesize that loss of AKAP palmitoylation and RE trafficking renders synapses more vulnerable to inhibition by Aβ due to altered CP-AMPAR regulation. We will test this hypothesis using in vitro cultured neurons and fluorescence imaging to characterize how Aβ regulates the trafficking of GluA1 CP-AMPARs to synapses in WT vs. CS mice. Using field electrophysiology, we will perform LTP and LTD protocols on acute brain slices to study how Aβ disrupts LTP in WT vs. CS mice through altered CP-AMPAR regulation.
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Understanding How Criminality Impacts Social Structures and Networks in a Rural Community
Angela Kirth, *Social Sciences & Humanities*
Mentor: Keith Guzik

Abstract:
The U.S. has been incarcerating around 2 million people at any given point in time for decades. The U.S. Department of Health and Human Services report that state and federal prisons release about 600,000 people per year and 9 million are processed through local jails. An ever-growing proportion of our population will have a criminal record. The effect of having a criminal record has been well documented to decrease the ability to find housing, employment, and receive social services. The stigma is well known with previous literature focusing primarily on urban environments or nationally representative surveys leaving rural communities less understood. A total of 9 participants were recruited as a convenience sample of people with no criminal record (NCR) (n=5), and those who do have a criminal record (CR) (n=4) have a criminal record. Semi-structured interviews were conducted to explore how having a criminal record or not affects social networks and structure in a rural community including group membership, stigma, reintegration, and recidivism. The most interesting finding was that fear was found to be more prominent among the CR group due to the stigma, perceived judgement, distrust, and according to one participant “They’re probably boring.” The NCR group were open to associating with people who had a criminal record because of belief in second chances, redemption, and hope for positive change but switching sides, trust, and determination were important for success. Crimes against children and violent crimes are unforgivable to all participants. This convenience sample included a variety of participants who wanted to share their voice and important perspectives. One commonality was the small social groups each participant reported which consisted of mainly friends and immediate family if there was a spouse and minor children. Only the two longest residing participants had at least one parent living in town.
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Understanding Microbial Metabolism: Investigating Bioremediation at the Lowry Landfill Superfund Site
Jaquelin Trujillo Muneton, *Natural & Physical Sciences*
Mentor: Christopher S. Miller

Abstract:
Waste management facilities play a crucial role in sustainable waste disposal. However, especially with historical landfills without modern construction practices, surface water may leach industrial and/or municipal contaminants, leading to groundwater contamination. The Lowry Landfill site in Aurora, Colorado was the primary landfill for Denver’s municipal and industrial waste in the 1960s and 1970s, and leaching from the site has contaminated groundwater with 1,4-dioxane, which is a potential carcinogen. Lowry is an EPA superfund site, and
the site operates a successful pump-and-treat plant that utilizes microorganisms in bioreactors to break down 1,4-dioxane that is present. Understanding the exact metabolism and dynamics of microorganisms within these facilities could aid in optimizing treatment processes and environmental sustainability. This study aims to characterize the microbial communities and metabolisms that are present in the treatment facility and investigate the roles they play in the breaking down 1,4 dioxane. Past work has demonstrated that there are

hundreds of different types of complex microbes present in the treatment facility. We use genome-enabled approaches and bioinformatics to study these microbial communities. We are extracting RNA from biofilms collected from the Lowry Landfill site, to characterize which organisms and which genes are expressed during normal site operation. We are optimizing RNA extractions from these complex Lowry samples to yield purified genetic material essential for measuring gene expression. This will allow for us to see which microbial metabolisms are active in the treatment facility, and to relate changes in activity to changes in site chemistry and performance.
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Understanding Public Transit Experiences for Women of Color
Hildana Liben , *Social Sciences & Humanities*
Mentor: Carrie Makarewicz

Abstract:
The Crime Prevention through Environmental Design (CPTED) guidelines, adapted to transit by the American Public Transportation Association (APTA) focus on implementing strategies of surveillance at transit stations and centers. CPTED guidelines intend to provide transit agencies with safety principles to foster effective utilization of their facilities through a range of recommended environmental design elements, such as security cameras, lighting, ground visibility, and increased transit police presence. This study's objective is to assess the guidelines adequacy in promoting perceptions of safety for student women of color riders of the Regional Transportation District's (RTD) light rail lines in the Denver Metropolitan Area. Phase one of this study included field research through survey and journal observations of ten stations in neighborhoods with different incomes –five in low-income communities, and five in upper-middle to higher income communities – to determine how neighborhood incomes interact with station safety elements to affect riders' safety perceptions. Phase two involves a study of ten college-aged women of color who use the same survey to evaluate the safety elements at four transit stations (two lower income and two higher income neighborhoods). Collected data is then analyzed to discover how well the unique concerns and experiences of young adult women of color are addressed through the safety measures used by RTD at their stations, and if relevant, whether the surrounding neighborhood plays a role in riders' perceptions. We anticipate the findings will suggest improvements for transit station environments, which may in turn create a safer experience for riders.
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Untargeted Metabolomic Analysis of Acute Ischemic Stroke With and Without Post-Stroke Infection
Tianah Reyes, Bethlehem Dawit, *Biomedical Sciences*
Mentor: Layne Dylla

Abstract:
Background: Post-stroke infection is a leading cause of mortality after acute ischemic stroke. To better understand the response to stroke, this study characterizes metabolomic differences in acute ischemic stroke patients with and without a post-stroke infection.
Methods: Whole blood samples were obtained upon emergency department arrival from patients with an acute ischemic stroke enrolled in the University of Colorado Emergency Medicine Specimen Bank between March 20, 2018 and March 20, 2023. We used untargeted high throughput mass spectrometry-based metabolomics to characterize metabolomic changes associated with post-stroke infection. Descriptive statistics characterized the cohort and the relative abundance of individual metabolites. We used a web-based analytical pipeline, MetaboAnalyst 5.0, to determine the structure within the dataset using principal component analysis (PCA) and partial least squares discriminant analysis (PLS-DA).
Results: There were 110 patients enrolled with average age of 65.3 years, equally split between males and females. The population was primarily white (68.2%) with 20.0% Hispanics. The top fifteen metabolites contributing to the greatest variance between those with and without a post-stroke infection upon PLS-DA included 4-acetamidobutanoate, guanidinoacetate, glucosamine, mannitol, and acylcarnitine (2:0). These metabolites (excluding acylcarnitines) were involved in arginine and proline metabolism, carnitine and fatty

acid metabolism, the tricarboxylic acid cycle, and tryptophan metabolism according to KEGG pathway analysis.
Conclusions: Patients with and without a post-stroke infection following an acute ischemic stroke differed in the relative abundance of several metabolites. The largest differences were appreciated in levels of 4-acetamidobutanoate, guanidinoacetate, glucosamine, mannitol, and acylcarnitine(2:0). Further studies will confirm these findings and leverage them to develop new therapeutic strategies to combat post-stroke infection.
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Unveiling Microbial Allies: Metagenomic Insights into 1,4-Dioxane Co-Metabolism for Environmental Remediation
Citclali-Aimee Tizcareno, *Natural & Physical Sciences*
Mentor: Dr. Timberley Roane

Abstract:
1,4-Dioxane is a chemical found in some everyday products like detergents and shampoos. When thrown away these products in the trash, they end up in landfills. Over time, rainwater or other liquids soak through the landfill, picking up the 1,4-dioxane along the way. If the landfill isn't sealed properly, the 1,4-dioxane can seep into the ground and contaminate the groundwater below. Once in the groundwater, it can spread and become a health and environmental risk. 1,4-Dioxane can degrade when exposed to oxygen. Scientists have discovered that certain microorganisms can help in breaking down 1,4-dioxane. These microorganisms use the chemical as a source of carbon and energy, effectively degrading it. They accomplish this by accepting electrons from the 1,4-dioxane molecules, which helps break them down. This process is known as co-metabolism. Providing an environmentally friendly solution to its removal. This study is focusing on using metagenomics and transcriptomics to identify the organism co-metabolizing with 1-4 dioxane. Currently, this is being done through utilizing alpha diversity analyses, like Operational Taxonomic Units (OTUs), Shannon's Diversity Index, and Faith's Diversity Index. These indices help reveal where this organism may fit taxonomically. OTU's through categorization of closely related organisms, Shannon's through measuring biodiversity in terms of species richness and evenness, And Faith's through incorporating information about phylogenetic relationships between species. In utilizing these indices, the goal is to discern patterns in the chemical dynamics of Lowry's 'ecosystem.' By examining fluctuations in 1,4-dioxane levels alongside readings from Shannon's, Faith, and OTUs indices, the aim is to narrow down the organism potentially co-metabolizing with 1,4-dioxane. Understanding its behavioral patterns and phylogenetics will then aid in narrowing down the group of microorganisms to which it may belong. In overcoming these challenges, this study contributes to our understanding of microbial interactions in environmental remediation efforts, paving the way for more effective strategies to mitigate the impact of 1,4-dioxane contamination.
https://symposium.foragerone.com/2024-racas/presentations/65498

Urban Greenery
Seann Smith, *Arts & Media*
Mentor: Ken Shroeppel

Abstract:
Urban Greenery is about empowering people by creating open-source tools to use Biochar. With a typical blender, water, and recycled paper, recycled paper pulp becomes the base cladding over recycled containers, such as discarded soda cans and milk containers. It acts as a canvas for artistic expression, perhaps mixed with Biochar, paints, and dyes. That cladding is then treated with a sugar solution to improve fire and water resistance.

A can opener can open the top of a soda can and leave no dangerous edges. Sliced down the side and reformed into a cone with a discarded twist-tie creates a container big enough for a spider plant and an example of how one can reconsider the simple conic shape of a soda can. For a larger container, milk

containers are large enough for a purple potato plant that produces a lot of nutritious leaves and is one of the more sustainable, healthy, and easily produced sources of food. The container is then filled with a soil mix (e.g., biochar, clay, and sand, in percentages that vary depending on the plant type).

Combining the carbon-capture, water-retention, and fertilization aspects of biochar, the work is to experiment with different designs of pots, soil mixes, and species of plants that work for people. Urban Greenery is a multifaceted approach to sustainability that engages the public at every level, at an individual level. Biochar, recycled materials, and artistic media serve as plant containers that provide an artistic outlet for people to produce sustainable solutions to equity, health, and wellness. From purple sweet potatoes combating food deserts to spider plants improving visual and air quality, Urban Greenery provides a way for people can contribute to a healthier and more sustainable future.
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Using immunohistochemistry to reveal dopamine D1 receptor signaling.
Lareina Alvarez, *Biomedical Sciences*
Mentor: Benjamin Greenwood

Abstract:
Extinction-based exposure therapy is commonly used to treat trauma related disorders, yet these therapies are susceptible to fear renewal after extinction. Renewal is the return of fear that occurs in a context different than the context where the extinction of fear was learned. Prior work from the Greenwood lab has reported that a microinjection of a dopamine D1 agonist into the dorsal striatum (DS) just prior to fear extinction reduced later renewal. Other research has found that the upregulation of D1 receptors within dopaminergic pathways are associated with the ability to adapt to trauma and stress. Therefore, this research indicates that D1 receptors in the DS are a potential target for the prevention of renewal, yet it is unclear which subregions in the DS are responsible for this process. To explore which subregions within the DS are important for preventing renewal, a dopamine D1 receptor (D1R) agonist SKF38393 was microinjected into either the dorsal lateral striatum (DLS) or the dorsal medial striatum (DMS) separately during fear extinction. Increasing D1R signaling in the DMS had no impact on renewal. However, increasing D1R signaling in the DLS reduced renewal. The reduction of renewal was measured with freezing, a behavioral response indicative of stress and anxiety. Yet pharmacologically there was no verification of the D1R agonist SKF38393 increasing D1R signaling within the DS subregion. The goal of this experiment is to verify increased D1R activity in the DMS and DLS by using immunohistochemistry. Antibodies targeting downstream phosphorylated proteins within the D1R pathway, such as p-DARPP-32 (PA5-105038), pCREB (06-519), and pS6 (P62753) are being used to verify increased D1R signaling. Increasing D1R signaling is hypothesized to increase downstream phosphorylated proteins, thus offering a way to evaluate the efficacy of the D1R agonist SKF38393. These findings would provide a novel way for D1R signaling verification.
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Using Microfluidic Spiral Microchannels to Wash Platelets With Dean Flows and Differential Migration
Jessica Dam, Yesenia Inzunza Atayde, *Biomedical Sciences*
Mentor: Rudra Dwivedi

Abstract:
Platelet purification is an essential technique employed to eradicate undesirable constituents from platelet-rich plasma (PRP). This is pivotal for the isolation of platelets for analytical purposes, including the examination of platelet dispersion, metabolic activity, and their function in flow-based assays. Conventional methods of platelet purification are often marred by the inadvertent activation and clumping of platelets, which culminates in a suboptimal recovery of unadulterated and viable platelets. To address this, the present device shows the opportunity to harnesses microfluidic technology to refine the differentiation of platelets from plasma impurities by incorporating a Dean flow mechanism.
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Validating inhibition of the neural pathway which facilitates the stress-protective effects of exercise
Simone Mellert, Britt Caniels, *Biomedical Sciences, Natural & Physical Sciences*
Mentor: Benjamin Greenwood

Abstract:
Stress makes serotonergic (5HT) neurons in the dorsal raphe nucleus (DRN) more active, and by doing so it produces anxiety and depression. In rats, voluntary wheel running (VWR) constrains the excessive activity of these DRN 5HT neurons, preventing behavioral consequences of stress. We hypothesized that activation of a specific inhibitory pathway from the nucleus accumbens (NAc) to the DRN 5HT neurons is necessary for VWR to provide stress resistance. Indeed, inhibition of this neural pathway restored stress-induced exaggerated fear in exercised rats. The goal of the current experiment was to determine if our approach actually inhibited the NAc-DRN pathway. Rats were injected with two viruses able to localize and inhibit the pathway in response to administration of a specific drug. RNAscope, which uses specific binding and amplification of fluorescent signals, was used to detect the precursor to 3 specific proteins in the NAc: two viral markers and a neural activation marker. The two viral markers should be expressed in all rats, both control (no inhibition of the pathway) and experimental (inhibition of the pathway), and both sedentary and VWR. If the NAc-DRN pathway is recruited during stress in exercised control rats, stress-induced neural activation should be higher in VWR versus sedentary rats. If inhibition of the pathway was successful, experimental rats should display attenuated neural activation in this pathway. This study illustrates a pathway that shows plasticity following VWR in response to inescapable stress and that can be manipulated.
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Virtual Reality (VR) for Determination of Motion Perception Thresholds in a Floating Environment.
Aaron Sullivan Stremel, *Tech, Engineering, & Math*
Mentor: Dr. Shengzhe (Jackson) Wang

Abstract:
In the face of rising oceans and a rapidly growing global population, the need for climate-conscious infrastructure becomes increasingly evident. Dynamic floating cities present an innovative solution to these challenges, yet their wide-scale development and implementation remains unfeasible due to the lack of regulation and guidelines surrounding their construction, particularly that of human comfort. Existing guidelines for tall buildings prove inadequate due to restraints in movement, and those for ships and sea vessels focus on seasickness and mental capability, which are higher thresholds than that of comfort. This project aims to address this gap through a novel exploration into the perceptual comfort aspects of human habitation in floating environments. The unique nature of a floating environment in addition to the lack of applicable research in this area calls for a new approach to understanding how occupants perceive their own movement. By leveraging Virtual Reality (VR) and Head Mounted Display (HMD) technology, we seek to establish baseline perception thresholds across various frequencies and degrees of freedom within a floating environment. Our research aims to contribute essential insights to the fields of structural and climate engineering, improving the feasibility and acceptance of floating projects. By examining the probabilistic nature of human perception thresholds through VR simulations, we can begin to answer some of the questions surrounding the reality of living within a floating city. This endeavor not only addresses a critical research gap, but paves the way for similar research in dynamic development.
https://symposium.foragerone.com/2024-racas/presentations/65536

Whole genome sequencing and analysis of limb enhancers in limb-reduced *Lerista* species
Harshini Ranjit, *Natural & Physical Sciences*
Mentor: Carlos Infante

Abstract:
Evolution can occur in many mysterious ways. A famous example of evolution is the loss of limbs in snakes. In fact, among squamate reptiles (the evolutionary group comprised of lizards and snakes) limb loss has occurred at least 25 times overall. However, the underlying genetic cause for the loss of limbs in these independent instances has not been clearly identified. The purpose of this research is to understand how gene regulatory regions, the regions in the genome that control the expression of genes, evolve and to discover what happens to them when they are no longer required by the organism. Specifically, to identify whether regulatory regions that are essential for limb development have either decayed via deletion and substitution or are conserved and perhaps recruited for new functions in lizards that have lost their limbs. To pursue this question, we focus on the Australian skink (Scincidae) genus *Lerista* that has evolved limb loss in multiple species. Therefore, it is an excellent system to study the fate of limb gene regulatory regions that promote gene expression also known as enhancers in species that have lost limbs. We have sequenced and assembled the complete genomes of ten limbed and limbless species of *Lerista* using Pacific Biosciences HiFi long read sequences. These complete genomes assemblies were then aligned along with outgroups using the whole-genome aligner Progressive Cactus. Known limb enhancers were taken from the literature and used to compare DNA sequence conservation between limbed and limbless species of *Lerista*. By looking at the differences in the known limb enhancers, it can be determined if there are any changes in regulatory regions between species in the genus, potentially revealing patterns and a pathway for future studies.
https://symposium.foragerone.com/2024-racas/presentations/65717

Work Identities: Deindustrialization and the Manpower Services Commission in Britain, 1973-1987
Sebastian Zegarra-Pardo, *Social Sciences & Humanities*
Mentor: Marjorie Levine-Clark

Abstract:
The concept of “work identity” as a topic of historical research has not received much attention. Historian Arthur McIvor and sociologist Mike Savage both recently published books that analyzed changes in British social identity since the 1940s, but neither have focused on work identity categorically. A work identity, as opposed to employment per se, reflects a person’s identification with, and relation to, a job or career orientation. The focus of my research is the adaptability of British work identities during the latter half of the twentieth century, when the economy and society underwent dramatic changes. More specifically, I am interested in the way the Manpower Services Commission (MSC), as a “mighty oak of [a] training empire,” facilitated changes in work identities for young people, women, and ethnic minorities, most of whom came from a working-class background. The MSC was created in 1973 during a critical phase of post-war deindustrialization and reflects, among other things, the class struggle that bedeviled Britain during that time. From its inception, the Commission sought to provide the government with comprehensive manpower policy that aimed to achieve and sustain full employment. I will discuss the MSC’s efforts to provide equal access to training and work opportunities and juxtapose them against cultural forces and ideas driving division among Britons. I will show that even MSC staff confined the work identities of some men and women by acting on unexamined discriminatory ideas. I will argue that unequal access to opportunity and status shaped differences in work identities between social classes. In conclusion, this project, by closely examining MSC documents, studies, and reports; by supporting individual narratives where my primary sources allow; and through a broad survey of secondary source literature on post-war Britain, sheds new light on the overlooked topic of work identities in current historical research through the lived experience of British people.
https://symposium.foragerone.com/2024-racas/presentations/65442

Woven Together
Malakye Tsosie, *Arts & Media*
Mentor: Andrew Bateman

Abstract:
Amidst the red rocks of Chaco Canyon, *Woven Together* unveils the tapestry of a Navajo family's life. It is to understand traditional knowledge from their mother and the sacred land they call home. Given that the film is about family, the Navajo culture is presented through an oral history identifying culture, memory, and reservation life. It enables indigenous representation to communicate life as it adapts to the Western world yet sustains traditional values. The goal is to document a matriarch's oral history and life through audio and visual mediums. Therefore, the film revolves around familial narratives that (maybe) haven't been seen coming off the Navajo Nation. Six of nine siblings are gathered for interviews that explore their experiences driven by their mother's wisdom. Before engaging within the Whitehorse Lake community, the group of filmmakers took the initiative led by the grandson to utilize the filmmaking process during pre-production meetings. Our final product of the film was weaving stories together that depicted the importance of educational literacy and the richness of Navajo Culture, expressed through rug weaving. *Woven Together* embarks on Navajo narratives that must be highlighted because viewers are typically drawn to documentaries for their informative aspects and speak truth to identity, whether culturally or traditionally.
https://symposium.foragerone.com/2024-racas/presentations/65525

A Comparison of Finite Element Analysis Methods: Keyak vs. Crawford
Saron Solomon, *Tech, Engineering, & Math*
Mentor: Dana Carpenter

Abstract:
Finite element analysis (FEA) is a computational method used to analyze complex structures and predict their response under specific conditions. In the field of biomechanics, FEA is a valuable tool for determining the relative strength of bone structures through analysis of stress distributions in the bone under applied external force(s) for application in orthopedic implants. Two prominent methods are the Crawford method, developed by Dr. Richard Crawford, which uses a displacement-based approach and focuses on bone deformation under applied loads (Crawford et al., 2003), and the Keyak method, developed by Dr. Joyce Keyak, which focuses on the ultimate strength of a limited number of elements to predict failure of the entire bone sample (Keyak et al., 1998). However, using each analysis method, FEA was conducted on the L1, L2 , L3, and T12 vertebrae of a female vertebral model. The vertebrae were tested until failure, comparing results with consideration of actual failure force values. It was found that the average difference in fracture forces between the two methods was 772.1 N, while the standard deviation of difference was 387.0 N, signifying considerable discrepancy and variability between results. However, the obtained regression value of 0.98 suggests similar overall trends between data sets and a strong linear relationship. Interestingly, both methods overestimated fracture force values, although more apparent with the Keyak method.
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