Welcome to 2021 Research and Creative Activities Symposium (RaCAS)!

Thank you for joining us for the 24th Annual (and 2nd Virtual) Research & Creative Activities Symposium!

RaCAS is CU Denver | Anschutz's annual celebration of student-driven research, scholarship, and artistic endeavors and this year features the work of more than 200 students. Each of these scholars has shown a remarkable ability to adapt, innovate, and create in the face of an unprecedented global pandemic and we are excited to showcase their work in this virtual format.

View All projects: https://symposium.foragerone.com/2021-racas/presentations

RACAS CATEGORY WINNERS

Arts & Media

- 1st Place - **Chelsea Minter-Brindley** - Contemporary Domesticity
- 2nd Place - **Ryan Breuer** - Investigating Interdisciplinary Communication Strategies Used by Artists and Engineers in the 3D Animation Industry
- 3rd Place - **Eric Rogers & Crystal Lee** - Leviiatha

Social Sciences & Humanities

- 1st Place - **Lucy Briggs** - Left Behind in Lockdown: COVID-19 and the Denver Unhoused Community
- 2nd Place - **Natalie Brehm** - Associations of Parental Infidelity with Child Outcomes: An Overview of Findings
- 3rd Place -**Grace Amundsen Barnkow, Britani Rudolph, Jordan Stopak-Behr** - Permitting a Better World: Revisions to the SeaTac Zoning Code to Improve Affordable Housing and Increase Equality

Science, Technology, Engineering, & Mathematics

- 1st Place - **Cisloynny Beauchamp-Perez** - Non-enzymatic post-translational modification of lysine clusters in C2 domains
- 2nd Place - **Haider Manzer** - Functional Analysis of the BspC Variable Domain in Group B Streptococcus
- 3rd Place - **Emily Warsavage** - Recruit to Food in Pavement Ant Foraging

Congratulations to the category winners and thank you to our 80+ volunteer judges for your reviews!

PEOPLE'S CHOICE AWARDS

- Arts & Humanities - **Jacob Garland & Erin Chang** - Lynx Creative Collective
- Biomedical Sciences - **Troy Hubert, Alyssa Hohorst, Margaret Tanner, Kelsey Bonar, Kelsey Abrams, William Whitworth** - Neural Mechanisms of Exercise-Induced Stress Resilience In Females
- Natural & Physical Sciences - **Kathryn Harris, Judit Bergfalk, Raphael Hatami, Rachel Vititoe** - Could Black Holes Explain Dark Matter?
- Social Sciences - **Josue Estrada, Katherine Feldman, Edith Huizar, Martin Nguyen, Carolina Sanchez Mendoza** - A Touch Of Humanity: Resources for Undocumented People and Advocates
- Tech, Engineering, & Math - **Jimmy Tangchittsumran, Leslie Fredrickson, Karl Larson, Danielle Piper, Devon Horton** - Project Revive Band

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SCHEDULE OF EVENTS

All Presentations | April 28-30 | Asynchronous

RaCAS Showcase | April 30 | Live

- Opening Kick-Off - 9:30 am
- Selected Student Presentations - 10:15 am - 3:30 pm
- Concurrent Data-to-Policy Symposium - 10 am - noon
- Awards and Closing - 4:00 pm

RaCAS 2021 Abstracts

Alphabetical By Title

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31 Days Denver
Shane Still (formerly Stillmunkes), *Arts & Humanities*
Mentor: Carol Golemboski

Abstract:
No one can deny the detrimental effects of the recent pandemic on the mental health of young people. *31 Days Denver* explores the records of 31 individuals through digital imagery and audio storytelling. As an artist, I strive to share stories that can help inform and diversify our changing world, especially other individuals' narratives. As a result, I came up with my most recent project, titled *31 Days Denver,* which delves into the current tribulations of Millennials and Gen-Zers during the COVID-19 pandemic. Millennials and Gen-Zers make up a large portion of the population and are the most at risk for mental health issues, so I set out to document their stories and share them with the world.

31 Days Denver begins on May 1, 2021, and ends May 31st. One participant will be shared each day throughout the month of mental health awareness - May. '@31daysdenver' can be found on Instagram, Facebook, TikTok, YouTube, Twitter, and LinkedIn, with its accompanying website - 31daysdenver.com.

Through storytelling, I aspire to destigmatize the negative social beliefs that have surrounded mental health. The pandemic intensified mental illnesses throughout the world, but these events show that there has been a need for mental health resources all along. The project deals with mental illnesses: sadness, loneliness, anxiety, loss, and despair. *31 Days Denver* critiques the negative social stigma of mental health and strives to demolish the barrier that forbade individuals from discussing their mental well-being.
https://symposium.foragerone.com/2021-racas/presentations/27611

A Memorial to Fabulous Women
Emily Przekwas, *Arts & Humanities*
Mentor: Rian Kerrane

Abstract:
Struck by the lack of monuments that exist to memorialize strong and powerful women, I decided to remedy this injustice for my thesis exhibition by creating a work of art to memorialize fabulous women. Visually, I was inspired by the Lincoln Catafalque, still used in the U.S. Capitol to honor fallen dignitaries. Ruth Bader Ginsburg was the first woman to lay in state on the Lincoln Catafalque this Fall. (Rosa Parks was the first woman to lay in state, but she did not use the Lincoln Catafalque). Typically sarcophagi are made using stone, but by using metal I am seeking to illustrate a more porous boundary between life and death. The work is existential in that way, especially as it pertains to my experience as a woman living in a society of pervasive male bias. Sometimes I wonder if I'm even alive.
https://symposium.foragerone.com/2021-racas/presentations/27446

A Novel Mask Insert to Reduce Habitual Particle Transmission
Tyler Burt, *Technology, Engineering, & Mathematics*

Mentor: Mr. Fred Doroshow and Mr. Charles Sprague

Abstract:
The CDC recommends that people wash their hands before and after touching their mask, and only touch it by the ear loops. However, as masks have become ubiquitous over the past year, it has become evident that many people have developed a habit of touching their mask, which could potentially contribute to the spread of particles, including those that cause COVID-19. To solve this problem, a novel device was created to help users remember not to touch their masks. The device is inserted into the filter pocket of a cloth mask and uses capacitive sensing technology to detect the proximity of a hand to the mask, triggering a vibrating motor to alert the user.

Participants were recruited from a high school population and asked to test the device in a matched-pairs experiment where each participant wore a mask with the device for one trial and a mask with the vibrating function disabled as a control trial. The device reduced the frequency of face touching from an average of 8.3 touches per hour to 4.3 touches per hour ($p=0.078$). Masks with the device were statistically no different in comfort and other subjective factors compared to the subjects' preferred masks, and the subjects demonstrated no overall preference between masks with and without the device.

By reducing users' mask-touching habits, this device could successfully reduce the spread of COVID-19 and other illnesses, and could have long-term applications in other hygiene-sensitive environments such as restaurants or hospitals, even after the pandemic.
https://symposium.foragerone.com/2021-racas/presentations/26387

A review of statistical methods applied to untargeted nutrimetabolomic data
Silvia Zavarella, *Biomedical Sciences, Natural & Physical Sciences, Technology, Engineering, & Mathematics*
Mentor: Dr. Audrey Hendricks

Abstract:
The primary goal of nutrimetabolomic studies is to reveal the biochemical phenotype in food directly and in human consumption through biological samples (e.g. plasma and urine) ultimately capturing interactions between diet, lifestyle, and health on a molecular level. Nutrimetabolomics has the potential to reliably predict dietary intake and could be a more objective and accurate measure to use in adjunct to food diary questionnaires, which are often subject to recall and other biases. More accurate measures of food consumption will enable precision nutrition and the study of the mechanism behind "healthy" diets or foods. Although there have been major strides in the area of nutrimetabolomics, addressing current challenges is essential to establishing biomarkers for identification of dietary patterns and associating those patterns with health outcomes. These challenges range from detecting variability by subgroup (e.g. biological sex, ethnicity), uniform bio-sample collection and processing, and effective statistical analysis methods. In this study we provide a review of current statistical methods being applied to untargeted nutrimetabolomic data. This compilation of current statistical workflows will assist researchers in identifying best practices and methods for study design and analysis as well as gaps in the field. Future plans for a benchmarking analysis comparing the methods on a uniform data set will provide further support to identify optimal statistical workflows for nutrimetabolomics biomarkers.
https://symposium.foragerone.com/2021-racas/presentations/27410

A Social History of Tartan
Hanah De Laurell, *Arts & Humanities*
Mentor: Dr. Maria Elena Buszek

Abstract:
Tartan is synonymous with Scottish culture and identity, represented today through a myriad of objects ranging from clothing to brand identity. This shift from Highland dress to Scotland's national dress occurred around the time of the last Jacobite Rebellion and the period of romanticization that occurred afterwards. This inquiry covers the Union of 1707 to the modern-day, looking at the development of tartan as a way to identify a connection between an individual and Scotland and the effects of globalism on this textile. Particular interest is shown in the connection of tartan with pop culture, through Victorian Balmorality and present-day representations in fashion and media, as well as the international connections developed throughout the last 314 years. This research shows how tartan developed into what it is today and how the interests of society and popular culture can influence identity for generations.
https://symposium.foragerone.com/2021-racas/presentations/27367

A Touch Of Humanity: Resources for Undocumented People and Advocates

Josue Estrada, Katherine Feldman, Edith Huizar, Martin Nguyen, Carolina Sanchez Mendoza, *Social Sciences*
Mentor: Trishia Vasquez

Abstract:
Prior research supports the need for improvement in access to health care (Horton, 2004; Andaya, 2017) for undocumented immigrants in the United States, and it also reveals the importance of advocacy work for one of the country's most vulnerable populations. The American Immigration Council estimates that the undocumented immigrant population in Colorado in 2016 was 190,000, compromising 34% of Colorado's total immigrant population (American Immigration Council, 2020). This group includes all foreign-born non-citizens who enter the U.S. without legal permission and valid documents, including individuals who overstay their legal immigrant visas. Access to health care services, affordable housing, fair labor, and employment law protections, are all significant barriers to health promotion and disease prevention for the undocumented immigrant community. Through large-scale asset mapping and community-based research, our goal was to create a grassroots advocacy platform via a website which will serve as an informative proxy for not only the undocumented community, but also for allies and the general public. We foresee this site as a place where undocumented immigrants, allies, and communtiy leaders can unite and share pertinent information, and become aware of pressing issues affecting the undocumented community. Research and resources regarding housing, education, labor, health, and immigration rights, will be translated into multiple languages, to make knowledge of such issues as accessible as possible. Through the compilation of this project, we have come to understand the many needs of the undocumented community in Colorado. We note that the endless obstacles undocumented immigrant communities face from marginalization, low socioeconomic status, and language barriers are by no means solved by the creation of a website, but we strongly believe it is a step forward in helping relieve some of the difficulties faced by this community.
https://symposium.foragerone.com/2021-racas/presentations/27449

An Analysis of Known Exonerations of Innocent Criminal Defendants in the United States Since 1989

Isabel Corona Guevara, *Data-to-Policy Project*
Mentor:

Abstract:
The National Registry of Exonerations contains information on a total of 2774 known exonerations in the United States since 1989. The number of years wrongfully imprisoned for these individuals range from 0 years to 58 years. While it should be a priority to avoid wrongful convictions in the first place, investigating the relationship between the number of years an individual spends wrongfully imprisoned and other factors can help develop policies which lead to faster

exonerations or remove policies which slow down this process; in order to minimize the number of years an innocent individual spends behind bars. We use a multiple linear regression model to investigate the relationship between the number of years wrongfully imprisoned and several explanatory variables such as age, sex, race, state of conviction, sentence, year of crime and reason for exoneration.
https://symposium.foragerone.com/2021-racas/presentations/27619

An Induced Pluripotent Stem Cell Model of Cell-ECM Interactions During Heart Development in Down Syndrome
Alyssa Salazar, *Biomedical Sciences*
Mentor: Dr. Jeffrey Jacot

Abstract:
Individuals with Down syndrome (DS) are 2000 times more likely to develop a congenital heart defect (CHD) than the typical population, yet the underlying mechanisms that cause DS-CHD remain unknown. The most common CHD phenotype presents as a septal defect, where a hole develops between the upper and/or lower chambers of the heart. An investigation of partial trisomy 21 cases with CHD revealed a narrowed candidate region on chromosome 21 for increased DS-CHD risk, encoding for type VI collagen (COLVI). Trisomy 21 overexpression of COLVI likely stiffens the endocardial cushions where septation begins – thus inducing an aberrant mechanotransductive response that could alter cell behavior and septal growth; however, this has yet to be determined. Therefore, we hypothesize that overexpression of COLVI alters cardiac cell adhesion, migration, and proliferation, predisposing the heart to a septal defect during development. To test this hypothesis, we differentiated six pairs of induced pluripotent stem cell (iPSC) lines from individuals with DS along with matched controls into cardiomyocytes (iPSC-CM). iPSC-CM were characterized using RT-qPCR for gene expression of cardiac markers and COLVI. To compare migratory and proliferative differences between DS and control groups, the iPSC-CM were seeded on extracellular matrix components commonly found in the endocardial cushions during cardiac development: Matrigel (a control), type 1 collagen, fibronectin, and increasing concentrations of type VI collagen (10, 25, 50, 100 ug/mL). Proliferation was measured over 48 hours, using the proliferative marker EdU. Migration was measured over 72 hours using IncuCyte® live-imaging technology. Results of both assays were analyzed using ImageJ (NIH). Elucidating dysregulated pathways in Down syndrome that impact cardiac septation will provide insight into the mechanisms that underlie the pathogenesis of CHDs, and could lead to improved therapies for the treatment of individuals with DS-CHD.
https://symposium.foragerone.com/2021-racas/presentations/27320

An Investigation of Individual Differences in Biological Motion Perception Within the Autism Phenotype
Jada Lister, *Social Sciences*
Mentor: Dr. Carly Leonard

Abstract:
To date, there has been little conclusive research examining the relationship between biological motion perception and the phenotypical traits associated with Autism Spectrum Disorder (ASD) within the general adult population. Biological motion refers to the ability to recognize a moving creature when presented with minimal visual information. The ability to perceive biological motion is important as it is rich in subtle social cues necessary for interpreting one's social environment. The phenomenon is relevant to ASD, which is defined by impairments in social and communicative skills, many of which are believed to result from core impairments in face processing. Our study will help us to better understand individual differences, and the relationship between biological motion detection, facial emotion discrimination and autistic-like traits in the typical adult population. This study examined perceptual performance using point-light display tasks that utilized clips of moving bodies and faces (presented as either upside down or upright) to

measure a participant's ability to identify the presence of biological motion or emotional content. The use of upside-down displays is intended to increase task difficulty, as biological motion perception is significantly affected by display inversion. The results of this task are hypothesized to correlate with questionnaires that measure aspects of personality including the BIS/BAS scale and the Five Factor Personality Questionnaire, as well as the Autism-Spectrum Quotient (AQ). The primary hypothesis is that AQ score, a measure of autistic-like traits, will correlate with performance on emotion-based discrimination tasks, but not with performance on tasks detecting biological motion.
https://symposium.foragerone.com/2021-racas/presentations/27347

Analysis of Covid-19 Death Rates by Continent
Marisa Bowens, *Data-to-Policy Project*
Mentor:

Abstract:
In this project, analysis was conducted for total death rate, due to Covid-19 within each continent, based on different variables from data obtained on April 1st, 2021. The variables used were: population density, extreme poverty, hospital beds per thousand, life expectancy, cardiovascular death rate, people aged 70 or older, and diabetes prevalence. The findings suggest that extreme poverty, cardiovascular death rate, and diabetes prevalence have an effect on the total death rate of the continents while the other variables do not. It is important to note that vaccination availability began a few weeks before April 1st, 2021 so the results given reflect this. Based on the findings, higher death rates causes, amongst the six continents that were investigated, were most likely linked to those who were either living in extreme poverty and those who were already experiencing pre-existing conditions, such as cardiovascular illnesses and diabetes. Therefore, policies that focus on quality healthcare for pre-existing health conditions like cardiovascular conditions and diabetes, as well as providing higher accessibility and accommodations for lower class populations will decrease the prevalence of death rates for possible future Pandemics.
https://symposium.foragerone.com/2021-racas/presentations/27307

Anime's Bizarre Adventures: Exploring Connections Between Influences of *Jojo's Bizarre Adventures*
Indy De La Luz, *Arts & Humanities*
Mentor: Maria Buszek

Abstract:
Japanese animation, or *anime*, has been an extremely popular media ever since its inception at the start of the 20th century. In particular, *Jojo's Bizarre Adventures*, known as *Jojo's*, is an anime that has garnered international popularity with demographics of all types and has inspired many projects, from fashion collections to themed cafes. Currently in its 5th season, it was created by Hirohiko Araki in 1987 as a Japanese graphic novel, or *manga*, and began airing twenty-five years later as an anime in 2012. It features a foreign main character, unthinkable to Araki's editors at the time, and takes inspiration from works of art across the globe, from Latin America to the Middle East. Motifs that exist in pieces by Paul Gauguin and the fashion and personas of David Bowie and Prince are merely the tip of the iceberg. My research consists of exploring the inspirations and influences of *Jojo's*, and its resulting contributions to local and global popular culture. Using this research is vital to the continued efforts of cultural historians to view anime more critically. Formal scholarship in anime studies is a recent practice that has emerged due to the explosive global interest in anime, to which I hope to contribute.
https://symposium.foragerone.com/2021-racas/presentations/27423

Associations between sleep, emotions, and health among pediatric patients with migraine

Hoda Sherif, *Biomedical Sciences, Social Sciences*
Mentor: Dr. Michelle Clementi

Abstract:
As one of the **leading causes of disability worldwide**, migraines are a neurological disorder characterized by debilitating headaches with a **prevalence** of roughly **10% in the pediatric population.** Pediatric patients with migraine have high rates of sleep problems, and emotional distress and obesity are also quite common in migraine populations. However, little research has examined how these health concerns are related to one another among pediatric patients with migraine. Therefore, this retrospective study **aims to characterize how sleep is associated with emotional health and physical health (headache, obesity) in a clinical sample of pediatric patients diagnosed with chronic or episodic migraine.** Ninety-five patients, ages 10-19 years, seen in the Children's Hospital Colorado Neurology Clinic completed self-reported measures of headache frequency/severity, sleep, anxiety, depression, and stress. Demographics, diagnoses, and body mass index (BMI) were collected from medical records. Correlation analyses indicated that **higher sleep problems were related to higher headache severity** (r = .22, p = .04), but not headache frequency. **Higher sleep problems were related to anxiety** (r = .54, p < .001), **depression** (r = .43, p < .001), and **stress** (r = .56, p < .001) but was **not related to BMI percentile**. A one-way ANCOVA and post hoc tests showed that **patients with** clinically significant **anxiety and depression had higher sleep problems** compared to those with anxiety only (p = .03) and those with **depression only** (p< .01), even when controlling for headache frequency. This study demonstrates **significant associations between sleep, headache severity, and emotional health in a pediatric specialty headache clinic population.** Sleep problems were **higher among patients with more severe emotional health concerns** (e.g., co-occurring anxiety and depressive symptoms) **and among female patients**. Future studies should consider how to better tailor intervention methods to address these interactions to improve health outcomes for pediatric patients with migraine.
https://symposium.foragerone.com/2021-racas/presentations/27464

Associations of Parental Infidelity with Child Outcomes: An Overview of Findings

Natalie Brehm, *Social Sciences*
Mentor: Dr. Elizabeth Allen

Abstract:
Infidelity is generally recognized as a life-altering event for couples and the family systems built around them. Much of the research and therapeutic focus has been on how the couple and the individuals within it may be impacted by infidelity, but little has been done to compile evidence and draw conclusions about potential differences found for children whose parents have engaged in infidelity and how this can be addressed in therapy. Therefore, I sought to summarize the literature that has described potential connections between parental infidelity and child outcomes. In order to conduct this research, I thoroughly searched and evaluated literature surrounding the topic to draw conclusions. Specifically, I reviewed literature regarding parental infidelity and the likelihood that a child will grow up to commit infidelity themselves or have disruptions in their mental well-being, attachment, or trust. The findings of this project illustrate that there are long-term outcomes for children related to parental infidelity, which further sheds light on the great importance of continued research and tailored therapeutic methods being available for children in such situations in order to better prevent these outcomes.
https://symposium.foragerone.com/2021-racas/presentations/27687

Autistic Traits, Altruism, and Emotional Processing

Emerald Saldyt, Esmeralda Lopez, Jeremiah Hartzell, *Social Sciences*
Mentor: Dr. David Albeck

Abstract:
BACKGROUND AND AIM: Autism Spectrum Conditions (ASC) have traditionally been assumed to have a unimodal symptom distribution and fewer studies have examined symptoms bimodally. Symptoms have been found to vary by social difficulties and detail orientation. There is evidence that those with ASCs are more reactive to neutral than positive or negative affective images, and even more so if the images contain inanimate objects of circumscribed interest (e.g. bridges, office supplies). Arousal to affective images has not been investigated when considering a bimodal distribution of symptoms. Using an online survey, we examine the clusters of symptom presentation and how they relate to various demographics such as gender, occupation or academic major, and how participants in these groups differ in altruistic behavior, emotion recognition, and emotional reactivity to affective images.
METHODS: We will assess autism using the Autism Spectrum Quotient (AQ), altruism using a dictator game, emotion recognition using the 'Reading the Mind in the Eyes' task, and emotional reactivity using subjective reports of arousal to affective images. Cluster analysis to compare subtypes of symptom presentation will be performed as well as regression analyses on type of occupation, academic major, and gender.
RESULTS: We hypothesize that those in the symptom cluster characterized by greater social difficulties and weaker detail orientation (cluster 1) will perform worse on the altruism and emotion recognition tasks and be less reactive to negative affective images compared to those in the cluster involving better social abilities and stronger detail orientation (cluster 2).
CONCLUSIONS: Understanding individual differences in affective processing and social behaviors in adult non-clinical samples will inform treatments to be tailored to specific presentation of autistic traits.
ACKNOWLEDGEMENTS AND FUNDING: This study has been funded by the Undergraduate Research Opportunities Program at the University of Colorado Denver.
https://symposium.foragerone.com/2021-racas/presentations/26824

Background Research for Narrative History Book Project on Mark Weiser & Xerox PARC

Lucas Duddles, *Arts & Humanities*
Mentor: Dr. John Tinnell

Abstract:
Despite his ideas being celebrated by Bill Gates and his work's profound influence on tech companies including Amazon, Apple, and Google, Mark Weiser and his work at XEROX's Palo Alto Research Center (PARC) in the 1990s remain relatively unknown to the average person. Dr. John Tinnell's book *The Philosopher of Palo Alto* seeks to fill this gap in popular knowledge and introduce the wider world to Weiser and his visionary work at PARC. My role in the research process involved conducting background research for the book. I researched key scientists working at the MIT Media Labs who were doing work that paralleled Weiser and his team at PARC's. I used the database Nexus Uni to find news articles on these scientists and their projects. After finding a relevant article, I would summarize it by bullet-pointing key focal points from the article, copying out any useful quotes, and including a brief note with my thoughts on how the article might be connect with the themes of the chapter or the book as a whole. Additionally, I summarized technical reports handpicked by Dr. Tinnell on specific inventions and projects from these scientists. My research helped flesh out the wider world of Dr. Tinnell's book narrative, especially for the chapter on artificial intelligence and "smart objects." My work highlighted the differing and frequently conflicting views held by prominent research scientists on artificial intelligence and the privacy concerns related to surveillance. These frequently stood in sharp opposition to Weiser and his team at PARC's views. Currently, Dr. Tinnell is finishing up the first draft of his manuscript. I will proofread chapters

from the book for grammatical errors, typos, and offering stylistic suggestions. The manuscript will then go to Dr. Tinnell's editor this summer, and the book will go into the second drafting phase.
https://symposium.foragerone.com/2021-racas/presentations/27442

Behavioral Habits and Covid-19 Positive/Death Rates
Yue Yu, *Data-to-Policy Project*
Mentor:

Abstract:
Since the end of 2019, we have fought with COVID-19 for more than 1 year. It has a huge impact on people's lives and puts a lot of pressure on the medical staff. This study aims to find a way based on people's daily lives to reduce the probability of the spread of the virus just like COVID-19. So, the research focuses on the impact of healthy behavioral habits on COVID-19 infection/death rates for each state in the U.S. Habits data includes obesity rate, daily vegetables/fruits rate, exercise rate, sugar drinks rate, and television watching rate, all clustered in different education levels, genders, races, and ages. Based on our findings, there is a significant relationship between habits and COVID-19 infection/death rates, so that we could give suggestions to policymakers like advocating people to exercise more in a more effective way. In addition, based on different clusters of data, we could also give some specific suggestions to different groups of people based on their ages and genders.
https://symposium.foragerone.com/2021-racas/presentations/27304

Behind Bars
Emily Przekwas, *Arts & Humanities*
Mentor: Rian Kerrane

Abstract:
Our criminal justice system operates much like a societal immune system. In this piece, I explored conceptually the biological elements of the immune system by creating phages out of bronze that are caught up in a metal structure. Just like the body can have auto-immune disorders and attack valuable and healthy cells, our society can target the wrong individuals and prosecute acts of passion or nobility inadvertently and condemn victims. This piece was inspired by the dual pandemics brought to light over the summer, that of covid-19 and structural systemic racism.
https://symposium.foragerone.com/2021-racas/presentations/27490

Black Community Health Awareness Response Team of Aurora Mission During COVID-19.
Kailyn Deavens , *Social Sciences*
Mentor: Dionisia Delacerda

Abstract:
Black Community Health Awareness Response Team (BCHART) is a fairly new team that was formed under the Colorado Black Health Collaborative. BCHART is here to support black and brown community members by connecting them to health and wellness resources in interactive forums. BCHART has made quite a significant appearance in its role in connecting with the black and brown communities during COVID-19. The main concern BCHART is trying to address is how to effectively reach out and educate the black and brown communities about COVID-19 and the opportunities to be vaccinated. To do so, BCHART must find the most efficient lines of communication and resources to connect with these

communities members. This research proposal intends to explain the process of getting BCHART in order, BCHART's long term mission, what resources have and haven't been obliging to interact with the black and brown communities, what areas are still in progress, questions that need to still be answered to improve BCHART, and a brief apprise on how to get other communities to sign up and become a BCHART of Aurora Educator volunteer.
https://symposium.foragerone.com/2021-racas/presentations/24955

Bohemian Origins: Frantisek Kupka's Contributions to French Anarchism in the Money Edition of L'Assiette au Beurre
Alexis Eastlake, *Arts & Humanities*
Mentor: Maria Buszek

Abstract:
Frantisek Kupka associated himself with many prominent anarchist thinkers in early 1900s Paris, and illustrated for the French anarchist magazine *L'Assiette au Beurre* before becoming a prominent abstract painter. In the *Money* edition of *L'Assiette au Beurre,* Kupka created a caricaturized personification of money, with a grotesque gold-filled potbelly, a top hat and modern suit, and a hook nose. *Money*—a brute force that destroyed all aspects of society—opposed Kupka's personifications of the working man, lady liberty, and religion. At the end of the periodical, the Greek goddess Athena vanquished *Money,* permitting humanity to literally pass through the golden gates of Utopia. Kupka's visions effectively reached the Parisian anarchist community: an estimated 25,000 to 40,000 people subscribed to *L'Assiette au Beurre*. In this presentation I will unpack the visual language Kupka used to create his character *Money*, and how the artist translated anarchist ideas in a way that the subscribers of *L'Assiette au Beurre* could understand. Throughout the *Money* issue, Kupka appealed to anarchist fears surrounding modern life and corruption, and anarchist hopes for a return to equality, simplicity, and science to best communicate with his wide audience. Kupka's illustrations in the *Money* issue provide insight into the minds of Parisian anarchists of the early 20th century, while situating Kupka's work within a broader social context.
https://symposium.foragerone.com/2021-racas/presentations/27346

Breakdown of Gluten Proteins using a Newly Identified Combination of Fruit Derived Enzymes to Alleviate Symptoms of Gluten Intolerance
Aditi Avinash, *Biomedical Sciences*
Mentor:

Abstract:
BACKGROUND- Three million people in the U.S alone suffer from gluten intolerance/celiac disease. My aim is to identify which of the natural fruits, and herbs have the ability to break down gluten and can reduce gluten intolerance. I selected kiwi, papaya skin, papaya leaf, pineapple, gooseberry, tulsi, dry amla (gooseberry) powder, fenugreek, ajwain, ginger, and kimchi as test materials for my experiment.

EXPERIMENTAL METHODS- I used a gluten testing kit to detect gluten in the substances. It contains strips with the G12 anti-gliadin antibody that specifically recognizes the gluten fraction and results in the appearance of a red line. In the absence of gluten, no red line appears. The intensity of the red line diminishes with the breakdown of gluten. I mixed wheat and the test materials with different ratios of wheat and test materials (1:1 or 1:3), to extract and evaluate the potency of test materials in the breakdown of gluten proteins.

RESULTS- Of the multiple natural substances tested, I found that when papaya skin, Kiwi, and pineapple extract are mixed individually with the wheat solution, these fruits were able to break down the gluten. Ginger is also a promising

candidate but not as effective as these fruits. These fruits have different digestive enzymes that played the main role in breaking down gluten. Also, I found that the combination of these three fruit extracts when mixed with wheat flour, demonstrated a synergistic effect in the breakdown of gluten. This is a novel finding.
https://symposium.foragerone.com/2021-racas/presentations/26961

Bryar County
Mason Weston, Anthony Battaglia, Caitlin Bassolino, *Arts & Humanities*
Mentor:

Abstract:
Bryar County is a Senior Thesis short film following Clint, a young man who loves his rural hometown but holds onto two secrets. The first: he's gay. The second: he is dear friends with Billy, the sole non-binary person in town who is in the early stages of discovering his own gender identity. Their friendship, kept a secret per Billy's advice, has helped Clint find inner acceptance, but acceptance is not the same as peace, and Clint is forced to consider what coming out might mean for his tranquil life with his mother and sister in his small town.

Bryar County is produced by students of the Film and Television program. MEIS student Alana Margolis of the all-female folk trio "Sister Neapolitan" provides some beautiful folk music to enhance the film's story. Our projected outcome is to screen the short at film festivals internationally in the hope that having more diverse representations of LGBTQ+ people on the big screen can continue to foster empathy and equality on a more grand social scale.

Nonbinary and genderfluid people rarely have on-screen representation, particularly in stories in rural settings like Bryar County. Many LGBTQ+ individuals in small isolated towns live in intense secrecy due to discrimination and threats of violence. We are proud to tell a story featuring queer characters because the more familiar the general population can become with diverse identities in fiction, the more we can understand, accept, and embrace one another in our own lives.
https://symposium.foragerone.com/2021-racas/presentations/27489

Burton, Shelley and Bakhtin: The Carnivalesque and Gothic Narrative in Tim Burton's Films
William Kealey, *Arts & Humanities*
Mentor: Maria Buszek

Abstract:
For nearly all of those who grew up in the early 21st century, the films of Tim Burton retain a special nostalgia in pop culture. His films inspired the youth of the 90's and 2000's to be unafraid and unapologetic for being different. The objective of this project is to understand the formidable impression that Burton's aesthetic left on its young audience and, furthermore, what inspired Burton's distinct aesthetic. Burton's films prove to be most memorable for their consistent juxtaposition of the macabre and whimsical. It is this exact quality of Burton's films that is rooted in Michael Bakhtin's theory of the *Carnivalesque* from *Rabelais and his World*. While Bakhtin was not a filmmaker or prominent artist, his philosophy behind the *Carnivalesque* was on the idea of humanities fondness for turning our society and morals upside down. Bakhtin's philosophy beckons the audience to question their inner desire and even the moralities of their given society through the allegory of the medieval carnival in which reversed hierarchical roles. Another highly influential factor on Burton's upside down aesthetic is the Gothic narrative and one of its most prominent writers, Mary Shelley. While Shelley didn't invent the Gothic genre, her story *Frankenstein* created the archetypes the Gothic narrative is known for today. In the tale, Shelley is keen on playing with her readers imagination, utilizing mystery to create

suspense and thrill. The story of *Frankenstein* popularized the castle archetype as well as pushed tales of the suspense and the supernatural into prominence in the early 19th century. I believe that without knowing about Burton's inspiration from past artwork and philosophies, it is impossible to understand the magnitude of his own influence.
https://symposium.foragerone.com/2021-racas/presentations/27413

Cannabis Legalization and Unsheltered Homeless Trends
Sharon Israel, *Data-to-Policy Project*
Mentor:

Abstract:
Data published by the U.S. Department of Housing and Urban Development (HUD) shows decreasing homelessness in state and national trends from 2011 to 2019. During the same period, some major cities in the U.S. experienced unprecedented increases in unsheltered homeless living in tent encampments, parking lots, and along public rights of way. Of the 48 major cities that participate in the annual HUD Point in Time survey, an instrument that collects data on homelessness nationwide, 16 are in states that legalized cannabis for both medical and recreational use between 2011 and 2019. The subject of this study is the relationship between legalization of cannabis and trends in unsheltered homeless in major U.S. cities. Using linear regression techniques and t-test statistical analysis, this study tested the null hypothesis that trends in unsheltered homeless located in major cities with legalized cannabis were not different than trends in unsheltered homeless where recreational and medical cannabis were not legal. The results of this study suggest that unsheltered homelessness in major cities increased from 2011 to 2019 in states that legalized cannabis during that period, where unsheltered homelessness in major cities without legalized cannabis did not. States with existing legalization and those considering legalizing cannabis for recreational and medical use need to be prepared for managing impacts related to increasing unsheltered homelessness. Legalization of cannabis use for non-medical purposes started less than a decade ago in the United States, and in some states has been legal for less than a calendar year. In this nascent and transitional stage of legalizing a substance that was previously prohibited, it is critical to continue examining the data from Point in Time surveys and support research in this area.
https://symposium.foragerone.com/2021-racas/presentations/27513

Cannabis-Induced Psychosis and Associations Between Cannabis and Schizophrenia
Lauren Moment, *Biomedical Sciences*
Mentor: Dr. Jonathan Shaffer

Abstract:
The deleterious effects of cannabis use on the brain, mind, and body have been studied for decades. The developing brain, particularly the adolescent and young adult brain, undergoes critical development that makes it especially susceptible to the effects of cannabis use. Among the negative effects of cannabis use in adolescence and young adulthood, psychosis, and psychotic disorders (e.g., schizophrenia) have been examined. The association of cannabis use with schizophrenia was first elucidated in a Swedish study of army conscripts. Specifically, conscripts, who perform compulsory military service, reported their cannabis use exposure and were followed longitudinally to assess the emergence of schizophrenia. The authors found that those who reported persistent cannabis use during adolescence had higher rates of schizophrenia diagnoses. Notwithstanding this correlation, a causal relationship has not yet been established between adolescent cannabis use and schizophrenia. Some believe that in the premorbid phase of schizophrenia one may self-medicate with cannabis, which may account for the correlational relationship. However, this evidence is not supported by the literature. Prolonged, frequent use of exogenous cannabinoids such as phytocannabinoids and synthetic cannabinoids perturb the endocannabinoid system, particularly during the critical

period of adolescence. This perturbation may contribute to psychosis and the pathogenesis of schizophrenia. In this review, I explain how cannabis may contribute to symptoms of psychosis and be associated with diagnoses of schizophrenia. PubMed and Google Scholar were used with the following search terms “cannabis-induced psychosis” AND schizophrenia. These search terms were narrowed by clicking on “adolescent.” Also, I explore, based on the diathesis-stress model, how cannabis may be one of many neurological insults leading to the onset of schizophrenia. In the future, research should be conducted focusing on other drugs as a trigger for schizophrenia.
https://symposium.foragerone.com/2021-racas/presentations/27250

Challenges in Implementing Cyber Security Requirements in County Departments of Human/Social Services
Breanne Benbenek, *Data-to-Policy Project*
Mentor:

Abstract:
Colorado’s public assistance programs including Food Assistance, Medicaid, Child Welfare, and Adult Protection are state-supervised and county-run. County Departments of Human/Social Services (counties) handle Protected Health Information (PHI) and Personally Identifiable Information (PII) on behalf of the State to administer these programs. This means that the security of Coloradans’ data is highly dependent on each county’s efforts. 43 of the 64 counties’ IT services are provided by the State (Option 2). 21 counties use their own funds to procure and provide IT services (Option 3). What we seek to learn is whether counties whose IT services are provided by the State makes them less likely to be in compliance with high-risk security standards. Control variables include County Population, Median Household Income, and County Size (based on % of population receiving Medicaid). The answer could mean the State should act to protect millions of Coloradans’ PHI and PII from cyber-attacks.
https://symposium.foragerone.com/2021-racas/presentations/27296

Characterizing IgG Antibodies in plasma and extracellular vesicles of patients with Glioblastoma and Meningioma
Daniel Lovasz, Zoë Zizzo, *Natural & Physical Sciences*
Mentor: Xiaoli Yu

Abstract:
Glioblastoma (GBM) is an aggressive brain tumor that is often fatal. Meningioma (MMA) is a nonfatal brain tumor formed from the meninge layers of the brain, of which 90% of them are benign. Previous findings suggest that tumor antibodies have decreased function from subtle proteolytic cleavage. We hypothesized that immunoglobulin G (IgG) antibodies in the plasma of brain tumor patients are abnormal, which play an important role in tumor pathogenesis. Using multiple immunoassays, we characterized IgG antibodies in plasma and plasma exosomes from patients with GBM (n=82), MMA(n=83), and controls of non-tumor CNS disorders and healthy donors (n=50). By capture ELISA, we found that significantly higher levels of Fc heavy chain IgG antibodies and IgG1 subclass are present in GBM plasma compared to MMA (p=0.0002 and p=0.0003, respectively). Similarly, extracellular vesicles purified from GBM plasma showed higher levels of IgG Fc heavy chain compared to that of MMA. In addition, immunohistochemistry demonstrated the presence of IgG antibodies in the brain tumors, concentrating around the periphery of the tumor. Importantly, we demonstrated that the IgG antibodies in both GBM plasma and exosomes produce complement-dependent cytotoxicity on a neuroblastoma cell line SH-SY5Y. The higher levels of IgG in the plasma and exosomes in GBM patients, and the high capacity of cell killing, suggest that GBM IgG antibodies may play an important role in tumor pathogenesis.
https://symposium.foragerone.com/2021-racas/presentations/30580

Characterizing IgG Antibodies in plasma and extracellular vesicles of patients with Glioblastoma and Meningioma
Daniel Lovasz, Zoë Zizzo, *Natural & Physical Sciences*
Mentor: Xiaoli Yu

Abstract:
Glioblastoma (GBM) is an aggressive brain tumor that is often fatal. Meningioma (MMA) is a nonfatal brain tumor formed from the meninge layers of the brain, of which 90% of them are benign. Previous findings suggest that tumor antibodies have decreased function from subtle proteolytic cleavage. We hypothesized that immunoglobulin G (IgG) antibodies in the plasma of brain tumor patients are abnormal, which play an important role in tumor pathogenesis. Using multiple immunoassays, we characterized IgG antibodies in plasma and plasma exosomes from patients with GBM (n=82), MMA(n=83), and controls of non-tumor CNS disorders and healthy donors (n=50). By capture ELISA, we found that significantly higher levels of Fc heavy chain IgG antibodies and IgG1 subclass are present in GBM plasma compared to MMA (p=0.0002 and p=0.0003, respectively). Similarly, extracellular vesicles purified from GBM plasma showed higher levels of IgG Fc heavy chain compared to that of MMA. In addition, immunohistochemistry demonstrated the presence of IgG antibodies in the brain tumors, concentrating around the periphery of the tumor. Importantly, we demonstrated that the IgG antibodies in both GBM plasma and exosomes produce complement-dependent cytotoxicity on a neuroblastoma cell line SH-SY5Y. The higher levels of IgG in the plasma and exosomes in GBM patients, and the high capacity of cell killing, suggest that GBM IgG antibodies may play an important role in tumor pathogenesis.
https://symposium.foragerone.com/2021-racas/presentations/30577

Checkbox: Other
Madison Santamaria, Cassandra LeFevre, *Arts & Humanities*
Mentor:

Abstract:
“What are you?” is a question that most people aren’t usually asked in a normal day-to-day conversation. Most people can be put off or confused by such a question, which is understandable in all cases, but being biracial, it is most times the first question asked right after “What is your name?” Being biracial is the definition of a “gray area”, because you are considered a minority, but you also have “white privilege” which results in the lack of affirmation from either side. You are everyone yet no one all at the same time.

Today’s society burns bright with the desire for equality, as it should. However, those of mixed races fall between the cracks. At a young age, we have to make the decision to choose one race to identify with in hopes of fitting in; we are reminded daily that we aren’t enough of one race when the other race is jokingly used against us, and when we want to speak out against racism we ask ourselves, “Am I even allowed to?”

“Checkbox: Other” sheds light on biracial cousins, Paisley and Maddy. While they are alike in almost every way -- being biracial, age, gender, and both are artists -- they learn about how each other's lives have been drastically different solely because of their ethnicities and appearance.
https://symposium.foragerone.com/2021-racas/presentations/27170

Commonly Abused Drugs Differentially Increase the Frequency and Amplitude of Accumbal Transient Dopamine Release Events
Hendrick Lopez-Beltran, Ryan Leman, *Biomedical Sciences*

Mentor: Erik B. Oleson

Abstract:
Drugs of abuse have been shown to increase dopamine concentration within the nucleus accumbens (NAc) shell, mimicking endogenous patterns of release that normally strengthen advantageous behavior and their rewarding effect at higher concentrations (Montague et al., 2004). However, due to lack of techniques able to measure transient dopamine release events with high temporal resolution, the dopamine release effects of each category of drug have not been previously characterized. Here, we examine the effects of induced dopamine transients within the NAc shell of ethanol exposed Long Evans rat en vivo model in effort to better characterize drugs of abuse and elucidate the neural machinery facilitating addictive behavior. Using fast scanning cyclic voltammetry (FSCV), an electrochemical technique with high temporal resolution that allows for real time measurements of dopamine concentrations, we found that the sedative-hypnotics, ethanol, zolpidem, and diazepam all increased frequency but decreased the amplitude (concentration) of dopamine release events. Alcohol exhibited a biphasic response that differentiate it from drugs of the same class. The opioid Heroin, synthetic cannabinoid WIN55,212-2, and psychostimulant methamphetamine increased both frequency and amplitude of dopamine release events. The psychostimulant MDMA also increased the amplitude of dopamine release events but did not alter their frequency response. This preliminary data reveals the varying effect drugs of abuse have on dopamine release events within the NAc shell.
https://symposium.foragerone.com/2021-racas/presentations/27485

Construction of Atomistic CLC^F F^-/H^+ Antiporter Models in Physiological Environment
Sierra Knodle , *Natural & Physical Sciences*
Mentor: Dr. Hai Lin

Abstract:
CLC^F F^-/H^+ antiporters are membrane proteins that are important for many organisms and specifically critical for the bacteria that utilize them to export F^- ions from their cytoplasm [1]. These bacteria include many oral bacteria that are major contributors to dental cavities. High F^- concentrations are toxic to these bacteria by causing enzymes such as enolase and pyrophosphatase to be inhibited and not functioning. The ability of these bacteria to export F^- through CLC^F allows them to survive. Thus, deciphering the operation mechanism of CLC^F may help us design new therapies for effective dental care. Although the closely-related homologous CLC Cl^-/H^+ antiporters have been extensively studied, the CLC^F antiporters are seldom studied, and their operating mechanisms remain unclear. In this project, we want to pinpoint how several previously identified key residues[2] contribute to the transport mechanisms through molecular modeling. To this end, a realistic atomistic model is critical. Here, we report the construction and equilibration of the CLC^F wild-type model embedded in lipid bilayers and solvated in aqueous solution. These models will be employed for subsequent simulations that help us to study the anion selectivity, in particular, the selection of F^- over Cl^- in the wildtype but the reversed Cl^--over-F^- choice in mutants such as E118Q and E118A[2], where the key residue E118 is replaced by glutamine and alanine, respectively. The knowledge will provide valuable insights for not only the CLC^F proteins, but also other homologous CLC antiporters as well.
https://symposium.foragerone.com/2021-racas/presentations/27615

Contemporary Domesticity
Chelsea Minter-Brindley, *Arts & Humanities*
Mentor: Carol Golemboski

Abstract:

Throughout the Covid-19 Pandemic, the United States has seen a steep decline in the number of women in the workforce. Roughly four times as many women as men have left their jobs, and that number continues to climb. This has resulted in a crisis within a crisis. Women's equity advancements have effectively been set back an entire generation. This crisis within the pandemic creates a few different problems: What is the impact to the pandemic induced labor force reduction? What are the long-term implications of gender equality for women?

Contemporary Domesticity seeks to examine women's expectations in the United States by applying my personal experiences as a mother, artist, and professional. The work engages the social and historical undertones relevant to many who face a return to Domesticity. *Contemporary Domesticity* exposes the often-overlooked link between the maternal and material.

The methods used to explore these effects involve cyanotype, an alternative photographic process, the creation of digital negatives from old photographs, and creating a workflow that is conducive to the home with little access to advanced equipment. The cyanotype process, dating back to 1842, as early origins of recording accurate botanical images make it appropriate to question the "nature" of the home, gendered role associations, and historical ideologies surrounding women and space.

The results of this exploration are in the form of a sculpture exhibited at the Emmanuel Art Gallery. Within *Contemporary Domesticity*, artworks include large pieces of cyanotyped fabric housed in traditional embroidery hoops that are suspended from a skylight in the ceiling on the Emmanuel Art Gallery's second floor. The structure of the circular hanging pieces is designed to emulate a "mobile." Each embroidery hoop is tied to a central structure that hovers above, creating a dangling display of circles connected by invisible threads.

https://symposium.foragerone.com/2021-racas/presentations/25732

Correlates of Hate Crime for a predictive linear regressions model

Ryan Leman, *Data-to-Policy Project*
Mentor:

Abstract:

Hate-related crime & hate crimes, especially in 2010-2011, represent one of the most important human rights issues the US currently contends with. These issues have deeply troubled our society in many of it's facets including our media, mental health, politics, foreign relations, and even how policing is done. What would be very helpful towards creating data-based policy to aid law enforcement & our judicial system is if we could predict, using commonly gathered data, the tendencies of hate crime occurrences. The purpose with this project was to create a linear regressions model by using statistical methods such as Pearson's product-moment correlation to decide which variables were predictive for hate crime occurrences as recorded by either the FBI & Southern Poverty Law Center. The academic research question being, from the dataset published on github from "fivethirtyeight" named hate-crime.csv, do some of these variables correlate with increases/decreases in hate crime occurrences per 100k people. If so, can such variables be used to create an accurate linear regressions model for the purpose of estimating future increases/decreases of hate crime occurrences. Such model could be used to influence policy related to the allocation of resources for hate crime education, training for police & lawyers, and even influence which law-firms train & hire defense/prosecution lawyers for hate crime specialization among many other uses. What I found by running a series of person's product-moment correlations was that according to 2005 FBI records, correlated variables included: median household income, percentage of population who are not citizens, gini index score, percentage of population not white, then an inverse correlation with percentage of population who voted for previous president D.J Trump. An ANOVA analysis confirms theses correlations with the gini index being the most predictive of hate crime followed by median household income then percent of population who are not citizens and lastly percent of population who are not white. I then do the same process except for hate crime reported by the Southern Poverty Law Center. Pearson's product-moment correlation findings show a correlation with median household income, percent of population above 25yr holding a high-school diploma, the gini index score, and again an inverse relationship with voters who voted for Trump. An ANOVA analysis

confirms 3 of the 4 variables as being significant. From most to least significant are the gini index, median household income then voters who voted for trump. This work represents a start to what could be refined into a very robust predictive model for hate crime & also teach us which issues, like wealth disparities measured via the gini index, we should also improve to reduce those tendencies that produce hate crime in our society.
https://symposium.foragerone.com/2021-racas/presentations/27556

Could Black Holes Explain Dark Matter?
Kathryn Harris, Judit Bergfalk, Raphael Hatami, Rachel Vititoe, *Natural & Physical Sciences*
Mentor: Anthony Villano

Abstract:
Researchers have observed that some of the stars around a galactic center are rotating faster than expected. Is there something we cannot see, or do we need to modify our laws of physics? There is evidence indicating that an additional component of the galaxy has not been accounted for. Both astronomers and physicists are focusing on finding this missing ingredient they simply call ‘dark matter’. Two of the possible types of objects they are considering are the elegantly named MACHOs (Massive Compact Halo Objects) and WIMPs (Weakly Interacting Massive Particles). The main focus of our research is to model the known components of the galaxy and investigate the effects on the rotation of stars. As a result, our rotation curve analyses of four galaxies confirm a "missing mass component." While scientists have traditionally modeled ‘dark matter’ as a microscopic particle, we consider the claim that it may actually be reasonable-sized black holes floating around the galaxy. The straightforward interactive plot available for the general public allows the user to explore these ideas themselves and compare them to the measured velocities.
https://symposium.foragerone.com/2021-racas/presentations/26710

COVID-19, SES, or Politics: What is driving disparities in COVID-19 vaccine administration in Colorado counties?
Kate Fitch, *Data-to-Policy Project*
Mentor:

Abstract:
The global effort to distribute COVID-19 vaccines has the potential to exacerbate health disparities and impede health equity. Disparate rates of vaccination in Colorado pose a threat to health equity for underrepresented populations. This research aims to identify predictors of COVID-19 vaccine administration in Colorado counties. Potential predictors in COVID-19 testing and case rates; socioeconomic factors including race, income, and education; and political leaning in the 2020 presidential election. The response variable being tested in linear regression modeling and observed in bivariate, multivariate, and mapping visualizations is cumulative COVID-19 vaccine doses administered per 100,000 population by county as of 3/20/2021. Preliminary evidence finds that political leaning is a significant predictor of vaccine administration and further analysis will attempt to determine whether this factor is independently associated with the outcome or as an interaction with other variables. The results of this research will be helpful in identifying strategies for improving COVID-19 vaccine uptake for low-uptake counties.
https://symposium.foragerone.com/2021-racas/presentations/27456

Creating a pedagogical toolkit for remote teaching: Leveraging Machine Learning
Biniyam Yohannes, *Technology, Engineering, & Mathematics*
Mentor: Ashis Kumer Biswas

Abstract:
Face-biometric-based technology has received a lot of criticism related to privacy issues and possible embedded biases leading to racism, sexism, and other societal challenges. New research is beginning to indicate that the critics may have been wrong. A recently released report by the National Institute of Standards and Technology (NIST) examined the accuracy of such algorithms across different demographic groups and found otherwise (NIST, 2020). In our project, we plan to first use face biometrics to solve a problem that instructors and students face in remote classrooms that leverage video conferencing technologies. One of the challenges that instructors are experiencing with this new mode of remote teaching is the inability to 'read the room' and interface with students' facial expressions, body language, and other overt verbal or non-verbal forms of communication. We are developing an Artificial Intelligence (AI) backed platform on top of a commercially available video conferencing tool, Zoom® to help the instructors 'read' their students' expressions. We do this by leveraging facial landmark detection followed by a generalizable recurrent neural network-based event categorization method that we design and develop will measure the level of attention of the attendees. In this talk, we will present preliminary findings including the data collection, processing, platform integration, and also outline some pedagogical strategies that could be recommended through AI in the pedagogical dashboard so as to benefit instructors to be more engaging in teaching.
https://symposium.foragerone.com/2021-racas/presentations/27459

Dark Matter Density Profiles of Edge-On Spiral Galaxies
Brittany Salmon, *Natural & Physical Sciences*
Mentor: Dr. Alberto Sadun, Dr. Masoud Asadi

Abstract:
Studying the mass density of dark matter throughout galaxies can help in revealing its illusive nature. Different dark matter density profiles have been created in order to gain an understanding of the density of dark matter within galaxies. The problem with these profiles is that they are based on data that has been simulated through N-body simulations. They are not based on real observational data. These simulations yield galactic rotation curves that are linear at large galactocentric distances. This is in contrast to rotation curves generated through observational data, which show a significant variation in the orbital velocity of matter at these same distances. These differences will yield very different density profiles. This project derives an accurate density profile using simple physics and mathematics, as well as basic assumptions in regard to the galactic system. By running real observational data through this profile, it is shown that not only is the orbital velocity of matter at large galactocentric distances within galaxies not linear, but the density of the dark matter within them is not monotonically decreasing as suggested by N-body simulated models.
https://symposium.foragerone.com/2021-racas/presentations/27447

Decriminalization Deaths: Effects of Decriminalizing Marijuana on Traffic Fatalities
Grace Amundsen Barnkow, Ashley Marsh, *Data-to-Policy Project*
Mentor: Serena Kim

Abstract:
Aims To evaluate the relationship between marijuana decriminalization and traffic fatalities in the United States.

Design Using publicly available data on Traffic Fatalities in units of Fatalities per 1000 People and Fatalities per Million Vehicle Miles Traveled (VMT), this study used a series of two-sample two-sided t-tests to compare a group of states that had decriminalized marijuana by 2019 against an artificial control group of states that had not decriminalized marijuana

by that date, using data from both before and after decriminalization, to determine if decriminalizing marijuana had a statistically significant impact on traffic fatalities in a state.

Setting The study used data from Alaska, California, Colorado, Delaware, Illinois, Maine, Maryland, Massachusetts, Nevada, New Hampshire, Oregon, Vermont, and Washington in the decriminalization group, and Connecticut, Hawaii, Indiana, Michigan, Minnesota, Nebraska, New Jersey, New York, Ohio, Rhode Island, Utah, Virginia, and Wisconsin in the synthetic criminalization control group. States were selected for the synthetic control group by eliminating states that still criminalized marijuana by 2019 but differed significantly (>5%) outside of the range of fatality values (in both units) defined by the states in the decriminalization group.

Participants The data represents 26 states from a population of 50 states, the District of Columbia, and Puerto Rico.

Findings The results of this study failed to reject the null hypothesis that there is no statistically significant difference between the artificial control group against decriminalization and the decriminalization control group in 2019 after the states in the decriminalization group decriminalized marijuana.

Conclusions The findings suggest concerns about decriminalization traffic deaths from marijuana from policymakers are largely misplaced, but there is room for more objective study in the field.
https://symposium.foragerone.com/2021-racas/presentations/22882

Defining Measures of Emergency Care Access in Low-and Middle-Income Countries
Jyotshila Dhakal, *Social Sciences*
Mentor: Dr. Corey Bills

Abstract:
Every year, about 5.7 million to 8.4 million lives are lost in low- and middle-income (LMIC) countries because of inadequate access to medical care.[1] Additionally, estimates suggest that 54% of annual deaths in low- and middle-income countries (LMICs) could be averted by implementation of quality emergency care systems (EMS). Previous reviews on EMS access are limited in scope and focus only in a singular area or community. However, this study focuses on barriers that affect communities in both LMC and LMICs. This includes a scoping review of English language peer-reviewed literature articles related to the measures of access and emergency care in LMICs and English language studies describing access to emergency or acute care services in LMICs, as defined by the World Bank Economic definitions. We categorized articles by the five access characteristics: affordability, availability, accessibility, accommodation, and acceptability as described in the study. Among quantitative articles, the outcomes related to various components of emergency care access are summated where appropriate. The qualitative articles described the barriers in certain areas based on the community's experience. In the beginning, abstracts of 1860 articles were screened to identify which ones met the criteria. After abstract screening and full text reviews, 50 articles met study inclusion criteria because of its heterogeneity in the methodological design, rested on varying definitions of access, and reported numerous outcomes. The majority of articles focused on general emergency care access (n=37, 74%); were situated in Africa (27, 51%); presented on availability and accessibility (N= 25, 50% and N=35, 70%, respectively). Further analysis of the different types of the various metrics of access is pending. Access to quality emergency care access in LMIC remains limited. Future studies coupling research into all aspects of access with emergency care quality are necessary to improve emergency care systems in such settings.
https://symposium.foragerone.com/2021-racas/presentations/27607

Denver Community Crime Solutions
Priscilla Moreno, *Data-to-Policy Project*
Mentor:

Abstract:
Through the sale of seized property, police forces across Colorado - and across much of the United States - have been purchasing military grade equipment to ramp up their show of force in response to large crowd events. In 2018, Denver law enforcement ascertained $1,044,042 through the sale of seized property. While crimes often appear as isolated incidents, we believe higher crime rates are a symptom of larger community issues at hand. Such issues include the lack of upward mobility, poor quality of life, and low education rates. Through the analysis of data obtained from the City and County of Denver's Open Data Catalog, this study aims to propose the reallocation of funds obtained through property seizure towards developing programs in the community to help prevent crime.

In our study, we investigate the effects of several economic and educational demographics on crime and look for ways to implement community development programs that might prevent future crime instead of spending funds on the militarization of police.

After analyzing crime rates per person in several Denver neighborhoods and comparing them to enrollment rates, median household incomes, percent of renters, percent of recreation and outdoor space, and more, we propose potential solutions to reducing and preventing crime in Denver neighborhoods through a multi-pronged approach of community development to be funded by the seizure of property.
https://symposium.foragerone.com/2021-racas/presentations/27263

Design for Life & Mortality
Ishea Lee, *Arts & Humanities*
Mentor: Arianne Collopy

Abstract:
When designing within a sensitive yet important opportunity space, designers of different disciplines may find themselves in a conscious or unconscious struggle to design effective solutions that are best catered to their user.
The purpose of this study is to define the contexts within a design process that results in the use of either the unconscious (automatic system) or conscious (reflective system). By understanding the causes, effects, as well as strengths and weaknesses of each of the two different systems, it is possible to better address where a design process falls short and causes frustration or ineffective solutions.
The study follows a series of design innovation workshops where users are asked to co-create with a partner. The goal of the workshops is to create a set of cards that encourages discussion about life and mortality through addressing user needs.
Notably participants who were measured to heavily utilize their reflective systems emphasized a higher difficulty intensity with the design process itself. Current pilot tests between participants with no design experience indicate a potential link between a user's 6-thinking hat preference and their approach with the Design Innovation (DI) Process. Due to the nature of the DI process relying on gathering, applying and creating with user insights, participants with a blue-hat preference are suggested to have a balanced use of their automatic and reflective systems. Additionally, participant perception of the opportunity space also effected their ability to design as well. With a negative perception, participants were seen and also mentioned struggling with the opportunity space.
https://symposium.foragerone.com/2021-racas/presentations/27473

Designing New Course in Sound Design for Student-Centered Learning in Higher Education

Ashell Fox, *Arts & Humanities*
Mentor: Cecilia Wu

Abstract:
The purpose of this project is to explore, develop and formalize a pedagogical approach to teaching sound design and technology in higher education.
Sound design is a fast-growing field which offers numerous job opportunities to our music students, especially in the music, film & television industries.
In addition, due to the growing accessibility of computers and advances in technology, it is becoming increasingly more common to work with sound design and audio manipulation tools.
Why do research in this field?
The development of teaching methods for sound design in higher education is a relatively unexplored field.
Moreover, the world is experiencing a global pandemic. Universities are rapidly adopting the online teaching format.
Many students (including myself) have expressed the difficulty of online learning.
Additionally, many students may be facing financial hardship due to the pandemic.
And lastly, it is important to remember that sound design is an abstract concept which requires a deep understanding of science and audio.
Because of these factors, Dr. Cecilia Wu and I took the opportunity to develop our sound design class with an affordable and easy-to understand approach.
https://symposium.foragerone.com/2021-racas/presentations/27389

Detection of *C. parvum* Transposons in Potable Water Using Genetically Engineered Bioelectric Sensors

Gitanjali Rao, *Natural & Physical Sciences*
Mentor: Dr. Michael McMurray

Abstract:
Cryptosporidiosis(Crypto) has a substantial health impact globally, particularly in lower-income countries and is the most common cause of waterborne disease in the world. My inspiration was drawn from Kakuma refugee-camp who commonly find cryptosporidium, also known as *C.parvum,* in their water. Current methods for detecting cryptosporidium require filtering large volumes of water and identifying the pathogen using a microscope. With genetic-engineering, the research goal is to develop a real-time solution for common people to indicate the presence of *C.parvum* in potable-water. The proposed solution uses CRISPR-cas9 to edit B. cereus microbe genetically, trigger a bioremediation pathway, and release an electrical impulse when C.parvum is identified. Gold-based electrodes and voltmetric transducers convert electrical impulse values into a digital voltage displayed as a directional result in a mobile-phone app. My work involved simulating the creation of a genetically-engineered B.cereus microbe and creating a correlation-map between the concentration of C.parvum and voltage released. A device was designed to measure the electric impulse using a biosensor. The detection works without the need for complex preparations and highly-trained technicians. In future, the test-results will be verified with the device-prototype. The solution can be expanded to detect other parasitic contaminants.
https://symposium.foragerone.com/2021-racas/presentations/24684

Determining an Applicable Formula to Guide Reprogramming for Intrathecal Baclofen Pumps Used to Treat Spasticity

Khoa Nguyen, *Biomedical Sciences*
Mentor: Sarah Graber; Kyle Kusmik

Abstract:
Spasticity is a condition involving abnormal muscle stiffness. The muscles remain contracted and are unable to relax, altering human functions like movement, speech, or gait. Baclofen is a muscle relaxer that treats symptoms of spasticity and can be delivered orally or intrathecally – where a pump is surgically implanted, and a catheter is ran directly into the patient's spinal cord to inject baclofen into cerebrospinal fluid. Intrathecal baclofen (ITB) dosage varies per patient and there is no definitive method to calculate a patient-specific dose. Incorrect dose settings can lead to complications of baclofen withdrawal and baclofen overdose. The baclofen pump project identifies variables that can influence baclofen drug overdose and withdrawal to determine an equation that calculates patient-specific baclofen doses. We hypothesize that a formula for reprogramming baclofen pumps after malfunction can be derived by correlating a set of preoperative variables retrospectively collected for previous pump revisions with a) the difference between the preoperative pump rate and the rate it was changed to at revision; and with b) the difference between the rate it was changed to at revision and the rate it was further changed to within a week of revision. Methodologically, this project involves two phases: 1) Identifying variables through comprehensive patient chart review of patients treated for spasticity via an ITB pump by the Department of Pediatric Neurosurgery at Children's Hospital Colorado; 2) Statistical analysis of database-organized parameter values from the chart review. Currently, phase 1 of the project has been completed. Preliminary analysis was conducted since the completion of phase 2 is yet to be determined.
https://symposium.foragerone.com/2021-racas/presentations/27470

Determining the Relationship Between Race Groups, Income, and the Rate of COVID-19 Deaths in Colorado

Stevenson Yip, *Natural & Physical Sciences*
Mentor: Erin E. Austin

Abstract:
COVID-19 in the United States has put the issue of healthcare discrepancies into the front of everyone's minds as people of different races are contracting and dying from the virus at a higher rate than others. The purpose of my research is to determine if (1) there is evidence of differences in the rate of COVID-19 deaths in Colorado between seven race groups, and (2) if income affects these differences.

We obtained the race and income data from the US Census Bureau and the COVID-19 data from the Colorado Department of Public Health & Environment. Race was defined as it is the US Census Bureau data, but we recognize that this is an imperfect definition that likely does not adequately capture all peoples' identities. Two-proportions Z-tests were used to test for differences in COVID-19 death rates by race. After applying the Bonferroni correction to account for multiple testing, 8 out of the 21 differences were significant at a 5% level. The greatest significant difference involved 'Multiple Races (non-Hispanic)', who had a 256% higher rate of dying from COVID-19 than 'American Indian or Alaska Native' in Colorado.

Linear regression was used to test for an association between COVID-19 death rates and income. Income was not related to COVID-19 death rates (p-value = 0.4525); COVID-19 death rates were not adjusted for income. Other social determinants of health, including education, the environment, and community stability, may be reflected in the potential health inequalities shown in the difference COVID-19 death rates. Systemic or institutionalized discrimination is also a possible source of these differences that deserves further research. In addition, our data were limited to publicly available county and state-level summaries. With individual-level data, we may be able to study the roles of the social determinants of health on COVID-19 death rates in more detail.
https://symposium.foragerone.com/2021-racas/presentations/27457

Developing tools to detect engineered biotinylated nuclear proteins

Kenneth Huynh, *Biomedical Sciences*
Mentor: Patricia Ernst

Abstract:
Chromatin which contains DNA and proteins, plays an important role in regulating gene expression. Various methods have been proposed for mapping specific chromatin features in the genome such as chromatin immunoprecipitation (ChIP), however these methods tend to lack specificity and affinity in targeted regions of the genome. To obtain a greater understanding of the MLL1 gene, which is crucial for fetal and adult hematopoiesis, in this research we describe a high specificity and high affinity biomolecular strategy. Our goal is to determine where MLL1 is in chromatin to identify directly regulated genes and distinguish from MLL1-dependent genes. Utilizing the specificity and affinity of streptavidin to biotin, we use a synthetically developed monomer called monomeric streptavidin (mSA). Using the monomeric form allows the detection of biotinylated proteins while avoiding the common issue of aggregation through multivalent binding. Attached to mSA is a transposase enzyme called Tn5 which, when MLL1 is detected, mSA-Tn5 binds to the biotinylated site marking it in the genome. Activation of the mSA-Tn5 requires the presence of biotinylated sites to function properly thus we include AviTag, which is a commercially developed 15 amino acid sequence, in mammalian cells. AviTag is a target of BiRA which is an E. coli biotin ligase and is highly specific in covalently attaching biotin molecules to the AviTag peptide. This is a new method to perform a transposase-based detection method for AviTagged MLL1. This method has implications for mapping numerous other regions of the genome that may be of interest. Currently, mSA-Tn5 have been detected in a flag-tagged western but isolation of the protein through chitin binding protein purification is needed to test the molecule in mammalian cells.
https://symposium.foragerone.com/2021-racas/presentations/27430

Development of a Tunable Computational Model of Bacterial Protein Translation

Jillyn Tittle, *Natural & Physical Sciences*
Mentor: John (Nick) Fisk

Abstract:
Individual biological processes within a bacterial cell are coordinated with and influenced by the holistic cellular environment. Computational models of cellular processes facilitate the investigation of the impact of variations of individual components on system functions. Despite improved experimental techniques and a growing store of data, the relationship between cellular growth rate and the concentrations of components of the translational machinery on the process of protein production have not been clearly established. Presently available computational models of translation do not account for changes in individual translational components with cellular growth rate. We developed a Monte Carlo simulation of protein translation which follows the complement of *E. coli* tRNAs through 17 kinetic steps and 3 potential ribosomal exit points, ultimately leading to the decoding of specified codons. The model employs three sets of kinetic parameters corresponding to cognate, near-cognate, or non-cognate codon-tRNA interactions. tRNAs were randomly selected to sample the codon based on experimentally-determined growth rate dependent concentration parameters. The model tallies times related to each kinetic step and produces distributions of amino acid insertion times, probabilities of error, numbers of near-cognate attempts, and numbers of non-cognate attempts for each of the 64 codons. Average insertion times ranted from 13-469 ms per amino acid, average error rates ranted from 0-164 for 10,000 amino acids, and near-cognate and non-cognate attempts range 0-42 and 7-241 per amino acid insertion, respectively. The model determined codon specific error rates at a level of detail beyond current experiments. Combining the calculated codon-level data produces estimates for the overall translation rate that closely matches the experimentally measured range of translation rates. The model makes many testable predictions about codon-

dependent error rates, how tRNA concentrations contribute to error rates, and how error rates are expected to change with cellular growth rate.
https://symposium.foragerone.com/2021-racas/presentations/27286

DFT Study of CO_2 Reduction by thiol-Protected gold Nanoclusters
Jae-Hwan Lim, *Natural & Physical Sciences*
Mentor: Dr. Emilie Guidez

Abstract:
This investigation explores the role of $Au_{25}(R)_{18}$ [R = SC_2NH_6] (cysteine amino acid) nanoclusters as a catalyst for the reduction of CO_2 into CO in the gas and solution phase using Density Functional Theory (DFT) computations. Preliminary computations show that throughout all the respectively charged $Au_{25}(SC_2NH_6)_{18}$ clusters in both water-solvated and non-solvated systems, the positions of CO_2 molecule deployed around the $Au_{25}(SC_2NH_6)_{18}$ clusters had a significant effect on the reduction potential of the CO_2. Additional calculations showed that the lower the overall energies (eV) of the $Au_{25}(R)_{18}(CO_2)$ complex correlated with a smaller CO_2 bond angle. This reduction of bond angles occurred in complexes where the carbon from the CO_2 would interact with the nitrogen from the cysteine ligand of the gold nanocluster. DFT calculations further indicated that the interaction energies of the non-solvated, positively charged complex $Au_{25}(SC_2NH_6)_{18}(CO_2)$ were lower than their solvated counterparts. The same positively charged $Au_{25}(SC_2NH_6)_{18}(CO_2)$ complex also exhibited the greatest charge transfer character molecule for each variation of the complex suggesting higher possibilities of reactivity compared to any other complex of different charge and environment.
https://symposium.foragerone.com/2021-racas/presentations/26218

Differential Associations of Social-Support Groups on PTSD
Brandon Choi, *Social Sciences*
Mentor: Elizabeth Allen

Abstract:
Following trauma-induced exposures, posttraumatic stress disorder (PTSD) is the most frequently diagnosed mental health disorder (Seal et al., 2007, Blais et al., 2021), estimated at 12%-16% of soldiers post-service (Vasterling et al., 2010). Research on PTSD has been ever expanding, and one area of study has investigated the effects of social support individuals receive. Studies have shown that social supports were positively associated to lower levels of posttraumatic stress symptoms (Smith et al., 2013; Gross et al., 2016). However, the majority of research have only looked the broad interactions of PTSD and social support, with a few studies investigating nuanced sources of social supports (i.e., civilian sources, military sources). A review by Blais and colleagues found that social supports from civilians and the home environment may be a more protective source of support and mitigation than support from military sources. To extend these findings, I will be evaluating the effects on PTSD from civilian-specific support groups: spouse, children, parents, extended family, civilian friends, religious belonging, health professionals, and the American public. With a sample of 497 service members from the PREP for Strong Bonds data set, I will be assessing the association between specific support groups and PTSD. Both variables are measured through self-reported questionnaires, with the Posttraumatic stress disorder checklist (PCL) as the specific scale for PTSD. It is expected that greater protective effects will come from sources that are closer and more personal (i.e., spouse, children, parents). Investigation of the associations from civilian-sourced support groups will expand our understanding of PTSD which can facilitate extensions of therapies, treatment designs, and the interpersonal relations for PTSD service members.
https://symposium.foragerone.com/2021-racas/presentations/27322

digital_theory
Kate Poppenhagen, *Arts & Humanities, Technology, Engineering, & Mathematics*
Mentor: Elizabeth Pugliano

Abstract:
I am an interdisciplinary digital humanities scholar who is interested in investigating how virtual reality can be used as a tool and a method for arts-based research. My project, digital_theory, draws together past arts-based research projects and mixed reality capture software, exploring how virtual reality can become a space of pedagogy and praxis. My past research has critically reflected on my work as a caregiver for adults with intellectual and developmental disabilities, and now I am exploring how my investigations into identity, subjectivity, and embodiment are expanded through my utilization of virtual reality and mixed reality capture software. I am also interested in exploring ways that research can become an immersive experience. I consider how the elements and principles of art can be used in conjunction with autoethnographic performance narratives to create immersive story spaces, transforming my research into the embodiment of care policy into a visual experience. Digital_theory also utilizes social media platforms, and seeks to validate digital spaces such as YouTube and Instagram as valuable and pertinent to digital humanities scholarship.
https://symposium.foragerone.com/2021-racas/presentations/27450

Does Religiosity Moderate the Association Between Pornography Interference and Marital Satisfaction?
Olivia Langwell, *Social Sciences*
Mentor: Dr. Elizabeth Allen

Abstract:
General pornography use has been associated with lower levels of marital satisfaction. However, there is little research into specific assessment of individuals' subjective sense of how pornography affects a relationship, and how specific moderators, such as religiosity, could impact the association of such subjective ratings and marital satisfaction. Given that common religious teachings include negative perceptions of pornography use, I predict when a couple reports high levels of religiosity, that the association between ratings of pornography's interference with the relationship and marital satisfaction will be stronger, compared to a couple that reports low levels of religiosity. This question will be evaluated with a sample of 535 heterosexual males and 553 heterosexual females recruited for a randomized clinical trial of a relationship education program. Data was collected through self-report measures of partner's use of pornography interfering with closeness and intimacy, marital satisfaction, and overall level of religiosity. My prediction will be tested using regression analyses which can test the degree to which ratings of pornography interference and religiosity interact to predict marital satisfaction. It is hoped that this project can inform intrapersonal contexts which can affect the ways that couples experience and navigate use of pornography. This information can be used to adapt relationship education programs and counseling suggestions for a couple to improve the relationship when these various components are present.
https://symposium.foragerone.com/2021-racas/presentations/27360

Down syndrome at the Intersections: Race, class, culture, and disability
Nuvia Trejo, *Social Sciences*
Mentor: Christine Sargent

Abstract:

Down syndrome is the most common genetic chromosomal disorder in the United States, but research about Down syndrome remains focused on medical, genetic, and behavioral dimensions of the condition. Our aim was to move beyond the medical models of Down syndrome and explore cultural, historical, and political forces that shape the lives of people with Down syndrome and their social networks. We initiated a literature review to examine international, domestic, and state perspectives about Down syndrome, paying particular attention to how authors engaged with race, ethnicity, class, and culture. We followed this literature review by mapping out Down syndrome organizations in Colorado and the services they provide both to people with Down syndrome and their families and/or caregivers. Our literature review reveals the need for intersectionally grounded research that focuses on intersections between Down syndrome and other aspects of identity, privilege, and belonging. These findings set the stage for developing a more holistic approach to Down syndrome research and will be used to develop an ethnographically driven project to better serve the social and cultural needs of local Down syndrome communities.
https://symposium.foragerone.com/2021-racas/presentations/27383

Drug and Protein Interactions within the Thyroid using Computational Chemistry
Blisa Mahmood, *Biomedical Sciences*
Mentor: Scott M. Reed Ph.D

Abstract:
Many drugs on the market are currently a one-size-fits all medication not tailored to an individual's genetic composition. Therefore, adverse drug reactions (ADRs) are a common reason for hospitalization in the United States. To prevent these ADRs, the study of Pharmacogenomics, how genes affect a person's response to drugs, can guide pharmaceutical companies into tailoring medications to an individual's genetic makeup. Using computational chemistry, researchers can gather more information on the mechanisms behind the ADRs.

Docking analysis in 11 mutant and native proteins populated distance scores along with a conformational change (RMSD) value for each protein. Ideally, lower distance scores between 1-2 angstroms and RMSD values farther from 0 are the desired values in showing the projected drug binding reaction. The threshold for this research was 0-3.7 angstroms for distance scores and 0.2-3 for RMSD.

The range of the distance score in the low natives was 2.240-3.474 with the correlating mutant scores ranging from 8.875-79.26. A low score in the native and higher in the mutant can be an indication that this protein binds higher to the native and can lose the ability to mutate.
The lowest distance scores in the mutants ranged from 2.155-3.682 with the correlating natives ranging from 3.377-103.7. A lower distance score in the mutant can be an indication that most people do not have a binding site for this drug in this protein, but in the rare mutation, a subset of people has a different shaped cavity in this protein, providing high binding in that site.

Quantitative data in the research provided a general idea of the protein and drug interactions. However, more qualitative data is needed to reinforce the theories behind drug binding, and the analysis of how drugs fit into the binding pocket.
https://symposium.foragerone.com/2021-racas/presentations/26904

Effective Community Engagement and Change
Maydha Kumar, *Social Sciences*
Mentor: Dionisia de la Cerda

Abstract:
Currently the US is aware that BIPOC communities are suffering more severe rates of Covid-19 compared to white communities. However, the government has not adequately investigated or responded to this issue. This forces the responsibility of investigation and resolution onto individual organizations. So, how do we create an effective means to gauge what a community needs and the means to achieve change? Typically, change is created through giving seminars and starting up resource centers. Some common survey responses to these seminars indicate the need for an action item or something the listeners can physically do to help resolve issues in their communities. Resource centers, one avenue to help resolve these issues, often face various obstacles that prevent them from serving the community to the best of their ability. In addition, other more interactive projects, such as the Denver Fridge Project, have yet to be evaluated on their effectiveness. Research into institutions such as these needs to be conducted to determine the best way to instigate social change on a community level.
https://symposium.foragerone.com/2021-racas/presentations/27483

Effects of Sex and Time on Stress Behaviors of *Teleopsis dalmanni*
Aurelia Valente, *Natural & Physical Sciences*
Mentor:

Abstract:
Many species have been shown to exhibit behavioral responses to environmental stressors. Stalk-eyed flies (*Teleopsis dalmanni*) present an interesting model for studying stress behaviors because their long, sexually-dimorphic eyestalks could lead to an evolution of behavioral differences between the sexes. Male and female stalk-eyed flies can be identified by the difference in their eye-stalks, which are larger and longer in males. Stalk-eyed flies have exhibited aggressive and anti-predatory behaviors, with notable differences by sex. In order to determine if stalk-eyed flies differed in stress responses by sex, male and female stalk-eyed flies were placed dorsally on fly paper and videotaped for a given treatment time of 30 seconds, one minute, five minutes, or ten minutes. Fly brains were removed for later analysis of brain monoamine levels via High Performance Liquid Chromatography as a physiological measure of stress response. The trial videos were observed in order to create an ethogram of noted stress behaviors. The ethogram was programmed into J-Watcher software, and the behaviors in the experimental videos of male and female flies with each treatment time were coded with each observed behavior. Behaviors were divided into high intensity behaviors, low intensity behaviors, and the resting state, and analyzed using JMP statistical software. There was no statistically significant difference between male and female fly stress responses. However, there was a significant difference in time spent in behaviors for both males and females. There was a decrease in time spent in low intensity and resting behaviors as the time intervals increased, compared an increase in high intensity behaviors. Brain monoamines will be investigated in order to further determine differences in fly stress behaviors.
https://symposium.foragerone.com/2021-racas/presentations/27377

Emergency Medicine Specimen Bank: Consenting Emergency Department Patients for Future Research Projects
Hannah Abroe, *Biomedical Sciences*
Mentor: Dr. Andrew Monte

Abstract:
The Emergency Medicine Specimen Bank (EMSB) was created in 2018 by PI Dr. Andrew Monte to collect blood samples from the patients that come into the UCH Emergency Department. The goal of the EMSB is to develop a biorepository utilized by researchers to expand the field of precision medicine and personalize acute care medicine. Current research

projects utilizing EMSB samples include genetic and epigenetic studies as well as studies on the effectiveness of ED treatments and health equity. Eligible patients (over 18, English or Spanish speaking, able to consent) are approached in the ED and given the opportunity to consent to give their blood samples to the EMSB. Blood samples of consented patients are collected at the beginning of their stay and disposition, then sorted and processed into the EMSB for future research use. Since the COVID-19 pandemic, samples of patients who have been COVID tested during their ED stay are not processed into the EMSB but sent to Biosafety Level 2+ labs for processing. Over the 2 years since implementation, the EMSB has consented >88,000 patients and collected >9,000 samples. The EMSB is significant because it allows investigators to conduct research studies from a large sample pool that will improve patient care and outcomes.
https://symposium.foragerone.com/2021-racas/presentations/27668

Empowering Women in the Fight Against HIV
Chris Clark, *Data-to-Policy Project*
Mentor:

Abstract:
In the decades since HIV became a household name, many areas of the world have managed to contain the affliction to subpopulations most vulnerable. However, this success is not universal. In particular, HIV remains prevalent in the general population on the African continent, especially in Sub-Saharan Africa, robbing children of parents, parents of children, and placing a significant economic and social burden on communities. Though much about HIV, from a biological, economic, and social standpoint is well understood, comparatively little attention has been paid to how empowered women can make informed choices about their sexual, educational, and economic lives that might mitigate the spread and strain of HIV. This project seeks to explore that relationship through analyzing the UNICEF State of the World's Children 2019 data set to find relationships between markers of women's empowerment or disempowerment and adolescent HIV in Sub-Saharan Africa.
https://symposium.foragerone.com/2021-racas/presentations/27279

Evaluation of Chemistry Student Knowledge of 5 Key a After One Year Later
Kathleen Le, *Natural & Physical Sciences*
Mentor: Dr. Priscilla Burrow

Abstract:
DFW (drop, fail, withdrawal) rates in STEM courses are traditionally higher than in other disciplines. The purpose of our research is to evaluate student knowledge in five core chemistry concepts: 1) physical and chemical properties, 2) stoichiometry and equations, 3) acid-base chemistry, 4) glassware and equipment and 5) written communication in chemistry. The basis of this project is to determine if the concepts are retained from the time that they are introduced through the general and organic chemistry course sequence. To determine concept mastery, students are tested on the same topics in General Chemistry One and Two, as well as Organic Chemistry One and Two. The questions used to measure concept mastery will be evaluated by a group of faculty and student volunteers. The CLAS Act grant has been ongoing for two years. During the first year, videos were implemented, and student quiz data was collected. The original intention of the videos was to provide the opportunity for repetitive exposure to the core concepts necessary for success in the four-course General and Organic course sequence as well as in subsequent chemistry courses. Quiz result data was presented at last year's RaCAS symposium. During the second year, student data was again collected, IRB approval was obtained, questionnaires were distributed to CU Denver Chemistry faculty for quiz question validation, and student interviews were conducted, also for the purpose of quiz question validation. Future action includes creating

more videos pertaining to the five core concepts and modifying the four-course sequence to encourage viewing of content videos and retention of core concepts.
https://symposium.foragerone.com/2021-racas/presentations/27390

Factors of COVID-19 Case Rate in USA
Cyril Waymel, *Data-to-Policy Project*
Mentor:

Abstract:
The objective of this analysis is to study the effect of the initial phase of the COVID-19 vaccine on the new case rate. The regression model that will be used includes data from January to March of 2021. In addition, state-wide mandates regarding limits on the size of social gatherings and facial coverings will be included in the model and used to further analyze the effect of the vaccine given the presence or absence of these regulations.
https://symposium.foragerone.com/2021-racas/presentations/27495

Factors that Lead to Strokes
Cameron Steenblock, *Data-to-Policy Project*
Mentor:

Abstract:
Other than heart disease, strokes are the leading cause of death worldwide. However, many people do not know what can help prevent strokes. Our data contains the information of over 5,000 people, including age, gender, medical information, lifestyle choices, and whether or not they have had a stroke. With this data, our goal is to use graphs that will identify the key factors that increase or decrease the likelihood of having a stroke. With this information we hope to introduce policies that will decrease stroke chances.
https://symposium.foragerone.com/2021-racas/presentations/27301

FES Cycling - A Remote Control for Paralyzed Legs
Adrienne Ellett, *Biomedical Sciences, Technology, Engineering, & Mathematics*
Mentor: George Marzloff

Abstract:
When a person suffers a spinal cord injury (SCI), the brain is no longer fully communicating with the muscles in their limbs. There are many long-term health effects associated with this, such as reduced lower limb motor control, and reduced muscle mass due to inactivity. One modality to combat the negative effects of an SCI is therapeutic exercises using functional electrical stimulation (FES). This process delivers electrical currents to target muscles, contracting them. The electrical patterns attempt to mimic the signals sent from the brain through an intact nervous system to peripheral muscles (hamstrings and quadriceps) for someone with an SCI. This project focused on FES cycling, in which leg muscles are stimulated to allow the patient to use a recumbent bike for exercise. Previous studies show that patients participating in FES cycling as part of their rehabilitation have increased blood flow to the legs, greater aerobic capacity, significantly reduced risk of cardiovascular disease, increased muscle mass and strength, and increased insulin sensitivity. This project will seek to improve the field of wearable FES devices for cycling, as current designs are quite costly. Our design uses acceleration data to determine the position of the user's legs while on a recumbent bike. First,

accelerometers fastened to each leg record acceleration data and send that to the main processing unit. That data is then processed using an algorithm that detects when each leg reaches certain points in the cycle. Then, the target muscles receive an electrical pulse to move the leg. The addition of wireless connections allow for more mobility for the user. Future work on this design will include the addition of an electrical amplifier to deliver sufficient current to contract the large muscles of the legs.
https://symposium.foragerone.com/2021-racas/presentations/30246

Film Research Assistant: A EUReCA! Work Study
Abby Pellien, *Arts & Humanities*
Mentor: Eric Jewett

Abstract:
Filmmaking is a process which involves synthesizing a product alongside others, going towards the same ultimate goal - a film that tells a story. Hopefully, it can be more than that, though, and that is what I learned throughout my Eureka! work study program this semester. As I got to know some of the ins and outs of the industry, I started to really enjoy being on long shooting days that would take 12 hours, strangely enough. It feels like you have a family around you and it doesn't have to be mundane or exhausting as long as you bring a positive mindset onto the shoot. Experience is something extremely important for young filmmakers, and it is also something many of them don't take advantage of opportunities because the work is too hard or they aren't getting paid, etc. I see free experience as something equally as valuable as getting paid because it will form connections with people in the industry. Essentially, you have to plant a seed everywhere you go as a filmmaker, and Eric Jewett really helped me understand that, encouraging me to look for more opportunities everywhere I go.
https://symposium.foragerone.com/2021-racas/presentations/27543

Financial Aid Award and Continuation Rates Among Colorado Undergraduates
Nicole Scribner Trout, *Data-to-Policy Project*
Mentor:

Abstract:
Although there are enormous income and quality-of-life benefits for those who complete a college degree compared to those with only a high-school education, financial constraints have been a long-standing barrier to American students accessing post-secondary education. Financial aid, a term referring to monetary aid from a variety of sources awarded to post-secondary students, helps many students reduce or eliminate their out-of-pocket college costs. In Colorado, financial aid is awarded both by need-based and merit-based criteria, and comes from numerous sources including federal programs, state programs, private sources, and from institutions directly. Using demographic-level enrollment, graduation, and financial aid data gathered from the Colorado Department of Higher Education, this study aims to analyze any connection between the percentage of students continuing in their undergraduate education at Colorado institutions each school year and the amount of financial aid awarded to each student cohort. We use correlation and regression analysis to describe the relationship between percentage of students continuing in various student demographics and financial aid award factors. The findings of this study may be used to influence distribution of financial aid funds in order to keep students enrolled in Colorado institutions of higher learning until graduation.
https://symposium.foragerone.com/2021-racas/presentations/27500

Finding drug-protein interactions in the stomach using computational chemistry

Isabel Dias-Bertch, *Biomedical Sciences*
Mentor: Scott Reed

Abstract:
Pharmacogenomics is the study of the reaction of someone's genome to a drug. Differences in people's genome describes the lack of universal reaction to a drug and is an explanation for adverse drug reactions (ADRs). This research is crucial because it allows people who are more susceptible to ADRs to avoid the use of certain drugs. It also may save money by bringing drugs that previously had ADRs and were taken off of the market, because researchers will know which specific people can take the drug without problems. This pharmacogenomic research is done using computational chemistry in order to find undiscovered ADRs. Computational chemistry consists of many methods of theoretical chemistry that are put into computer programs in order to model drugs, proteins, and then dock the two together. The distances of the binding locations can be compared native vs mutant proteins and the data can be reported. For the mutant stomach protein ANXA10 at position 12 the drug Maraviroc was found to bind 2.99 angstroms from the binding site. When a point mutation occurs from the amino acid phenylalanine to serine, the drug binds 2.99 angstroms from the mutation site. While for the native protein the drug binds 3.34 angstroms from the expected site. In order to account for hydrogen bonding distances around 3.2 angstroms are ideal because this shows the drug is binding close to the expected site. After the point mutation the conformational change of the protein (RMSD) was found to have a value of 1.468 angstroms. Researchers already know that ADR drugs bind elsewhere after a point mutation; therefore the larger the RMSD value the bigger impact the mutation has on the drug binding, making larger values more exemplary.
https://symposium.foragerone.com/2021-racas/presentations/27163

Fine-Scale Ancestry Detection in East Asian Population

Souha Tifour, *Technology, Engineering, & Mathematics*
Mentor: Audrey Hendricks

Abstract:
One type of summary genetic data is genetic data that is pooled across many individuals into allele frequencies. Summary genetic data has high utility in research because it can be easily accessed by the research community. There are multiple large publicly available resources with summary genetic data. For example, gnomAD is a resource that assembles exome and genome sequencing data from a variety of large-scale sequencing projects that is available for the scientific community. GnomAD v3 has 76,156 genomes. There are different ancestral populations represented in gnomAD. Some of the gnomAD groups are admixed populations, meaning they contain multiple continental reference ancestries (e.g. African-American, Latinx groups). Population structure refers to differences in allele frequencies between populations and subpopulations. Population structure needs to be corrected for in most genetic analyses to avoid confounding. Yet, one of the barriers of publicly available genetic summary data is that it is hard to determine the underlying population structure. Summix is a new and efficient method that identifies, estimates, and adjusts for the proportion of continental reference ancestry in publicly available summary genetic data (e.g., in gnomAD). Summix currently uses reference data from 5 ancestry groups to obtain estimates of continental ancestry within summary data. These continental groups are African, Non-Finnish European, East Asian, Indigenous American, and South Asian. However, even within these continental ancestry groups, there is a finer scale population substructure (e.g., Chinese Dai, Han Chinese, Japanese, etc in East Asia). Therefore, the next step is to evaluate Summix's utility to estimate fine-scale ancestry. Determining fine-scale ancestry may help to better adjust for population substructure and give researchers helpful information about what fine-scale populations are in summary data. Here, I test the performance of Summix in estimating fine-scale ancestry in the East Asian group from gnomAD v3. I use East Asian subpopulations from the 1000

Genomes Project and the Human Genome Diversity Project as reference populations to determine fine-scale ancestry in the gnomAD East Asian population.
https://symposium.foragerone.com/2021-racas/presentations/27625

First Generation Students/ Non First Generation looking at their test scores along with preparation
Daniela Villalobos, *Data-to-Policy Project*
Mentor:

Abstract:
I work with First Generation high school students and the programs purpose is to help them in anything they need specially when it comes to preparing them for standardized tests. I want to see which students are performing the best and if First Generation has anything to do with it. Before just looking at First Generation it is important to look at Preparation, how students with free and reduced lunch are doing, along with race, and gender. Therefor I need to see if there is a correlation between these variables and test scores for each Math, Reading, and Writing. I am getting my data from Kaggle, under Education there is Students Performance in Exams .This lets me look at data from multiple students (1,000 observations to be exact), like gender, race, preparation, parental level of education, lunch, Math score, Writing score, and Reading score. In total there are 8 variables. The only variables that are numeric are the test scores, every thing else is words like male/female for Gender for test preparation we have none/completed. With this I hope to find if there is something that effects tests scores or correlates with them.

Do students with a high scores have high scores for everything? Did they prepare? Who does better males or females, or does that not play apart? Or does First Generation play a role? My response variables are the tests scores because what matters to me is who is getting the highest test scores. For my unique predicator I want to look into test preparation, gender, race, lunch, parental level of education, and then compare the test scores to each other. With these I will use a scatter plot and density plot, to begin with. The scatter plot will help with looking for correlation. I may even color code for male and female. What I do next depends on those initial graphs. With what is found or with more research, I hope this will benefit the education system when it comes to helping students whether it turns out to be First generation or not, or reduced lunch or not, whether it is through programs or rules set to help students be able to succeed and given the resources needed.
https://symposium.foragerone.com/2021-racas/presentations/27546

Food Availability for Honeybees (Apis mellifera) in a Semi-Arid Environment, Denver Colorado
Hillary Hillam, *Natural & Physical Sciences*
Mentor: Christy Briles Ph.D

Abstract:
Urban development degrades and reduces natural ecosystems and has effects on bee populations and their food supply. A lack of forage can cause bee populations to decline due to nutritional stress, while floral abundance can increase forage and bee abundance. This study is to evaluate the forage sources honeybees use for nectar in the urban and suburban semi-arid environment, Denver Colorado. Honey from nine hives were sampled during September 2020 (five hives located in the Littleton area and four hives on Auraria campus), processed chemically to isolate individual pollen grains, and counted and analyzed to determine abundance and amount of resource types available for bees. The main resource utilized in both Denver and Littleton was *Tilia* (linden), a tree that produces both nectar and pollen for bees, followed by Rhamnaceae (buckthorn) and Fabaceae (clover). A total of 18 common pollen types were identified across both areas showing the polylectic (collects pollen from a variety of plants) tendency particular to honeybees. This data is

useful to the planning of urban development by identifying necessary resources used by honeybees within the urban and suburban landscape where resources are scarce.
https://symposium.foragerone.com/2021-racas/presentations/27435

Food Resources for Native Bees in Denver, CO
Melissa Allen, *Natural & Physical Sciences*
Mentor: Dr. Christy Briles

Abstract:
Pollination is an important ecological service that is important to plant and insect diversity, especially in urban environments where native pollinators are in decline. This study documents the types and diversity of pollen that different native bee species use in a semi-arid urban environment. Live bees were netted, identified, and pollen was collected and stored on cotton swabs that were then processed to extract pollen grains that could be identified. Twenty-three different pollen-types were represented, with Fabaceae (clover), *Spirea* (meadowsweet), Asteraceae (daisy) and Lamiaceae (mint) pollen grains dominating across all genera of bees collected. The *Megachile* (leaf-cutter) and *Halictus* (sweat bees) bees collected up to 17 pollen types and *Bombus* (bumblebee) bees had the least pollen-type diversity with only 2 pollen types represented. Native bees sourced from both native and non-native plants seen both in the field and from pollen data. The data will be useful to urban planners, landscape architects, park managers and the public to target specific types of plants when developing gardens to support native pollinators in Denver's resource-limited environment. The results also expand on existing data on native bee resources in other urban and suburban environments.
https://symposium.foragerone.com/2021-racas/presentations/27480

Free/Reduced Price Lunch Eligibility and Access to Arts Education in Los Angeles County PreK-8 Public Schools
Madilyn Tyner, *Data-to-Policy Project*
Mentor: Dr. Serena Kim

Abstract:
Despite the social and academic benefits of arts education, such programs are lacking in many Los Angeles County public schools. Our study used linear regression through STATA to determine if there is a relationship between percentage of students eligible for free and reduced priced lunch (FRPL) and availability of arts education in Los Angeles County PreK-8 public schools. While we did not find a significant relationship between these two variables, we did find that schools with higher populations of non-White students and those districts with lower median household incomes had less access to arts disciplines. There was also a positive correlation between school size and availability of arts education. As a result, we propose treating art as a core subject with regulated standards to promote equity in accessibility to art education. California's education budgeting formula should also be restructured to allocate more funding to art education.
https://symposium.foragerone.com/2021-racas/presentations/27516

Functional Analysis of the BspC Variable Domain in Group B Streptococcus
Haider Manzer, *Biomedical Sciences*
Mentor: Dr. Kelly Doran

Abstract:
Streptococcus agalactiae, or Group B Streptococcus (GBS), is a Gram-positive bacterium which colonizes the cervicovaginal tract in 20-30% of healthy women. Colonization is asymptomatic; however, GBS can be vertically transmitted to newborns, causing pneumonia, sepsis, and meningitis. Bacterial meningitis is a serious infection of the central nervous system (CNS) that occurs after bacteria interact with and penetrate the blood-brain barrier (BBB). GBS is the principle etiologic agent of neonatal bacterial meningitis and results in 10-15% mortality despite antibiotic treatment, with permanent brain damage in 40-50% of the survivors. We recently identified the role of the surface adhesin BspC in the pathogenesis of GBS meningitis via interaction with the host receptor vimentin expressed on the endothelial cells of the BBB. Δ*bspC* mutants exhibited decreased virulence compared to WT in a murine model, as well as reduced adherence to human brain cerebral endothelial cells (hCMEC), inducing inflammation in both systems. The molecular details regarding the BspC – vimentin interaction are unknown and represent a potential therapeutic target to prevent disease. Based on homology to similar proteins and *in silico* analysis, we hypothesize that the variable domain of BspC contains a vimentin-binding pocket.

We confirmed that the BspC variable domain interacts with vimentin using MicroScale Thermophoresis and showed that recombinant variable domain protein is able to block adherence of GBS to hCMEC in a BspC dependent manner. Mutations surrounding the binding pocket generated via site directed mutagenesis decrease both of these *in vitro* phenotypes and also decrease the ability of a point mutant strain to enter the brain as compared to a WT BspC expressing strain within an *in vivo* murine model for meningitis. Finally, we used a virtual structure-based drug screen to find compounds that would fit within the BspC variable domain pocket and identified a drug that is able to block the BspC variable domain – vimentin interaction and also GBS adherence to hCMEC in a BspC dependent manner. Collectively, this data indicates that the BspC variable domain contains a vimentin-binding pocket that can be blocked with a drug to prevent disease.
https://symposium.foragerone.com/2021-racas/presentations/26896

Gender Stereotypes, Powerlessness, and a Lack of Self-Worth: A Content Analysis of Twelve-Step Literature
Kathryn Yazgulian, *Social Sciences*
Mentor: Dr. Tamara Powell

Abstract:
This project examines the highly gendered language used in twelve-step programs for friends and family of addicts, such as Al-Anon, and the implications these messages can have on a program's members. These programs, specifically the language used in the program's literature, can be far from inclusive, deterring those who may be seeking help in the form of twelve-step fellowship. By performing content analysis on foundational literature within the Al-Anon program, I clarify the relationship between gender stereotypes, the notion of powerlessness, and how these concepts affect how self-worth is communicated. To find this connection, I analyzed sections of *Alcoholics Anonymous* and *Courage to Change*, both pillars of Al-Anon literature, and abstracted four main themes: maleness is the correct state of being, women are inadequate, women should aim to have desirable traits, as determined by husbands, and members are powerless. These messages challenge the empowering value of twelve-step programs, acting to further marginalize members of their community while simultaneously denying the marginalized member's self-worth.
https://symposium.foragerone.com/2021-racas/presentations/26937

Global Childhoods: Historical Emergence of Third Culture Kids
Liz Evans, *Social Sciences*
Mentor: Dr. Soumia Bardhan

Abstract:
Given today's mobility friendly global climate, companies and businesses are increasingly sending their employees abroad to represent their interests. Within that rise in circulation of people, the children of such sojourners develop their own association with multiple cultures of impact. This is an interdisciplinary exploration into the emergence of the concept Third Culture Kid (TCK) or a person who spends a significant portion of their developmental years outside of their parents' country of origin. The goal of this study is to explore the historical context in which the term TCK emerged and discuss how it has evolved to accommodate the unique intercultural dynamics TCKs experience today. The study address the challenges and advantages that come with liminal living that characterize TCKs, who have the potential to use their experiences to serve as effective culture brokers during times of deep divisiveness. More research by intercultural communication scholars on the TCK population is needed to better understand and aid TCKs, and in turn facilitate cross/intercultural understanding.
https://symposium.foragerone.com/2021-racas/presentations/26010

Holistic Approach to Understanding and Combating Child Poverty in Colorado
David Palcsak, *Data-to-Policy Project*
Mentor:

Abstract:
Children living in families with an income below the federal poverty level, as defined by the United States Office of Management and Budget, are considered to be living in poverty. For a family of four, the poverty level in 2017 was $24,600. Children living in poverty are more likely to experience education, health, and emotional development issues, as well as many more mental and physical barriers not just in their childhood, but during their adult lives as well. Research has shown that children are more likely to live in poverty than adults, but children rarely have a platform to speak on in the realm of politics. This paper aims to provide a voice for the youth in the political process by examining the causes of childhood poverty in the United States. The goal of this research is to find areas in Colorado that display factors that are shown to have a correlation to youth poverty by analyzing how socioeconomic and environmental factors relate to youth poverty around the United States. Once the 'at-risk' areas in Colorado are identified, policy can be recommended to effectively direct resources toward lowering the number of youths living in poverty in Colorado. Preliminary results have shown that youth living in areas with higher Native American, Hispanic, and Black populations, higher rates of violent crimes, and average teacher salary are more likely to live in poverty. Further analysis will determine whether or not these factors and others can help identify counties in Colorado that need additional resources to combat youth poverty.
https://symposium.foragerone.com/2021-racas/presentations/27531

Housing Availability in Denver Neighborhoods
Adelle Price, *Data-to-Policy Project*
Mentor:

Abstract:
This study aims to examine the availability of housing (detailed as the number of vacant housing options) within Denver neighborhoods. The data analyzed is from the American Community Survey Nbrhd and reflects 5 year averages taken from 2013 to 2017. Using applied linear regression, the study examines potential causal relationships between the outcome variable: number of vacant houses, and predictor variables: percent of two or more races, median age per

neighborhood, total housing units, number of family households, median gross rent, median home value, and percent of families in poverty.
https://symposium.foragerone.com/2021-racas/presentations/27526

How EUReCA! Changed My Life
joshua bergren, *Arts & Humanities*
Mentor: Jashodhara Sen

Abstract:
The EUReCA work study program has been very influential on my life and was a huge turning point in my career. For the presentation I wanted to tell a story about my past, and where I was before the work-study. I then want to transition from where I used to be, to where I am now.

This with be an 8 minute audio tape, in a podcast style. I wanted the words to speak for themselves, and I think a live video would take away from the meaning a little bit.

The goal of this presentation is to inspire people to never give up, and how the EUReCA! program can really help people progress not only in their professional career, but in their personal lives as well.
https://symposium.foragerone.com/2021-racas/presentations/27702

How Rhetoric and Legislation Impact Undocumented Immigrant's Ability to Find Housing
Juan Franco, *Social Sciences*
Mentor: Marisa Westbrook

Abstract:
The recent spike in development and gentrification in the U.S, Colorado has driven up housing costs, displaced low-income individuals of color, and exposed the vulnerabilities of undocumented immigrants. Through this summer fellowship, I will write a literature review of the impacts of housing legislation and rhetoric on undocumented immigrants. Immigrants are at a greater risk for housing discrimination within the US; this is especially true for the case of undocumented immigrants. Legislation often excludes protections for noncitizens, making it significantly more difficult for immigrants to access housing and benefit from fair housing laws. Using the scientific literature on housing and documentation status, legislative records on housing standards, patterns of development and funding for low-income neighborhoods, and Census data of the tenants of a neighborhood over time, I plan to identify the relationships between scientific researchers and legislative rhetoric, and the impact it has on undocumented immigrants. Impacts I will explore in this literature review may include the ability to find safe and well-maintained housing, the ability to afford housing based on work availability, and the ability for those communities to have input into housing advocacy and legislation. As the immigration debate continues, it is important to understand how our rhetoric and legislation impacts an immigrants ability to house themselves.
https://symposium.foragerone.com/2021-racas/presentations/30184

Hungry for Equality: Fighting Food Deserts
Drew Horton, *Data-to-Policy Project*
Mentor:

Abstract:
Food deserts are a form of food insecurity related to a lack of access to healthy, fresh, and affordable food. The US Department of Agriculture(USDA) defines a food desert in an urban area to be a region more than one mile away from a grocery store. According to the USDA, 13.7 million households in the U.S. experienced food insecurity in 2019, and this burden disproportionately affects marginalized communities. This problem has only been exacerbated by the ongoing COVID-19 pandemic, with an unprecedented number of people in extreme poverty, and many more at risk. To address the food insecurities in our community, we construct two integer programs that will produce an optimal distribution of grocery store locations. The first program minimizes the average distance of residents to a grocery store. For the second program, we minimize over the Kolm-Pollak EDE(Equally Distributed Equivalent), a measure of inequality. When we minimize the average distance, we ignore the worst off members in our communities, whereas in minimizing inequality, we are ensuring we address the marginalized population. Through comparing the resulting distributions produced from each program, we demonstrate the importance of assessing inequality within a community as a step towards addressing equity. Specifically, we hope to encourage policy makers to consider intervention strategies that prioritize relief in disproportionately affected communities.
https://symposium.foragerone.com/2021-racas/presentations/27528

Hybrid Instruments for Middle Ear Surgery
Ian Garvin, *Biomedical Sciences*
Mentor: Dr. Steven Lammers

Abstract:
We have designed a Stainless Steel/Nitinol hybrid instrument for surgical interventions in the middle ear. Current instruments lack flexibility and adaptability. Despite the wide range of shapes, lengths, and tip geometries that are available, unique anatomical features often render existing instruments unsuitable for specific patient surgical procedures. This creates a need for a tool that can be adjusted intraprocedurally to account for the structural and anatomical variability within the middle ear. A hybrid instrument with shape-memory properties fills this need. During an operation a surgeon could bend and reshape the instrument as necessary for one task, then straighten it back into its original shape using heat. This process can be repeated for numerous tasks during one operation, as well as over the lifespan of the tool. Since the original shape of the instrument is completely recovered upon heating, there is reduced risk of liability to the surgeon for using previously deformed tools. The tool morphology chosen for this prototype was the House-Crabtree dissector pick, an instrument with a long thin handle which tapers to a small hook projection which sits at a right angle to the long axis of the tool. To create a Nitinol/Stainless Steel hybrid tool, a Nitinol section at the distal end of the tool has been attached to the Stainless Steel handle using a Stainless Steel collar. Although the tool itself is still in the prototyping phase, it was designed based on the results of force-deflection models in MATLAB and SolidWORKS, and static mechanics simulations in SolidWORKS. The accuracy of these models and simulations were evaluated by mechanical testing on an MTS machine with a 5N load cell. These results, combined with feedback from the client for this project, contributed to determining optimum Nitinol wire diameter and tip length.
https://symposium.foragerone.com/2021-racas/presentations/27443

Hydrophobic Core Folding Properties of the Villin Headpiece HP36 Protein Subdomain
Jillian Oviedo, *Natural & Physical Sciences*
Mentor: Hai Lin

Abstract:

Hydrophobic cores are sites of complex protein folding is misfolding patterns, and they often define protein stability and folding overall. Headpiece-36 (HP36) is a convenient model system to study the hydrophobic core interactions and dynamics due to its small size (36) residues and cooperative folding. Here, we study the molecular dynamics of HP36 in the powder state as used in the solid-state NMR measurement by Dr. Vugmeyster, with the focus on three phenylalanine side-chains, F47, F51, and F58 belonging to the hydrophobic core under different hydration levels (144%, 40%, and 10%). The potential mean force (PMF) of the sidechain rotations of these phenylalanine residues are computed using umbrella sampling, providing implications on the plasticity and rigidity of hydrophobic core dynamics, which are compared with experimental solid-state NMR results.
https://symposium.foragerone.com/2021-racas/presentations/27560

Ideas About Biocentrism: Developments Across Space and Time
Ilana Amaria, *Social Sciences*
Mentor: Dr. Christoph Stefes

Abstract:
The present geological era is referred to as the Anthropocene, an epoch in which humankind has emerged as a topographical force. Economic growth and concomitant consumerism largely cause the anthropocenic destruction of nature, exploitation of wildlife, and marginalization of its intrinsic value. Synthesizing the voices of prominent ideational thinkers, this project pivots around one central question: Why, in the age of human dominion, is emphasis placed on wildlife preservation?

Mark Blyth analyzes the recent turn to ideas in political discourse as a response to the limits of rational choice theory and the tendency of research to orient around change rather than stasis. More narrowly, Martha Finnemore questions why states intervene in fields where there is little material payoff. Within an ideational paradigm, intervention becomes more explicable as a reaction to the increasing power of norms and ideas than to rationalist cost-benefit analyses.

When superimposing preservation narratives onto this schema, two inextricable lines of questioning emerge. First, how have ideas about preservation developed in response to an evolving institutional landscape? And second, how successfully have these ideas changed discourse and the policymaking process? Strikingly, ideas serve both as the explanation and the very thing to be explained, simultaneously an answer and a question.

Because ideational institutionalism is a newer field in political science, much ground is left unexplored. In aid of this lacuna, this project will harness the explanatory power of comparative politics, empirical notions of conservation progress, and the theoretical framework of ideational institutionalism to answer how ideas about conservation are embedded in institutions, when and how this process occurred, and what challenges this development faces. Highlighting such concepts as ordered change, discursive patterns, and actor agency, this project seeks a nuanced understanding of ideas and institutions through a comparison of wildlife protection efforts in the United States and Germany.
https://symposium.foragerone.com/2021-racas/presentations/30229

Impact of a Fluid Management Algorithm on Acute Kidney Injury in Pediatric Patients supported on ECMO
Ananya Shah, *Biomedical Sciences*
Mentor: Dr. Katja Gist DO, MSc

Abstract:

Extracorporeal membrane oxygenation (ECMO) is an artificial system employed to provide temporary respiratory and circulatory support for those who are unable to sustain adequate gas exchange or perfusion to sustain life. In both adult and pediatric populations, those on ECMO represent some of the most critically ill patients, and despite vast technological advances in the past few decades, outcomes remain poor. ECMO application is still limited by a variety of complications including, but not limited to, infection, fasciotomy, bleeding, and most pertinent to this study, acute kidney injury (AKI). Multiple prior pediatric studies have shown that patients on ECMO frequently develop AKI and fluid overload (FO), both of which are associated with an increased risk for adverse outcomes including: increased mortality, increased ECMO duration, increased ICU stay, increased mechanical ventilator duration, ECMO mortality, and worse oxygenation. Despite the proven association between AKI development and poor outcomes, AKI is still under-diagnosed or diagnosed at a later stage. Early recognition and early implementation of management strategies, such as treatment algorithms, are vital to improve patient outcomes. The purpose of this study was to evaluate the impact of a fluid management algorithm on the AKI incidence, fluid accumulation, and mortality for pediatric patients supported by ECMO. Multivariable logistic regression and descriptive statistics were used to analyze the data collected from retrospective chart review of all the patients who required ECMO at Children's Hospital CO from January 2011 to December 2019. Out of the 299 patients who required ECMO during that period, the fluid algorithm was implemented for 75 patients. It was determined that implementation of the fluid management algorithm was associated with a 58% reduction in the odds of AKI and a 14% reduction in mortality rates for pediatric and neonatal patients requiring ECMO. No significant difference was observed in percent FO pre-ECMO and end-ECMO between algorithm patients and non-algorithm patients. A multicenter prospective study further evaluating the use and outcomes of this fluid management algorithm is necessary to validate these findings.
https://symposium.foragerone.com/2021-racas/presentations/26888

Impact of antibiotic pollution on ammonia-oxidizing bacteria residing in freshwater ecosystems
Noha Eljalafi , *Natural & Physical Sciences*
Mentor: Annika Mosier

Abstract:
Microbial nitrogen (N) cycling is inextricably linked to the health of freshwater ecosystems, and yet human influence on these systems (e.g., through agriculture and wastewater runoff) has caused a suite of environmental problems. For example, antibiotic pollution can have harmful impacts on bacteria naturally residing in rivers. Although antibiotics are intended to eliminate pathogenic bacteria, they also have wide mechanisms of action (e.g., inhibition of cell wall synthesis) that affect bacterial abundance, population structure, and function. Here, we are evaluating the impact of antibiotic pollution on ammonia-oxidizing bacteria (AOB, which oxidize ammonia to nitrite) in freshwater systems. We cultured three strains of AOB from the South Platte River Basin in Colorado and sequenced their genomes. Preliminary research showed that the genomes encoded several proteins predicted to confer antibiotic resistance. We are using cultivation and physiology experiments to test these genomic predictions. We hypothesize that AOB maintain ammonia oxidation throughout exposure to elevated antibiotic concentrations. AOB cultures are grown in minimal media containing ammonia (as an inorganic energy source) and bicarbonate (as an inorganic carbon source). Ammonia oxidation is measured by testing for the presence of nitrite (the end-product of the energy metabolism) using a mixed Griess reagent. Cultures will be subjected to elevated concentrations (50-5000 nM) of antibiotics commonly found in the South Platte River Basin waterways. Overall, these results will shed light on whether or not freshwater AOB are resilient and are able to maintain nitrogen cycling—a critical ecosystem service—in the face of antibiotic pollution from wastewater and agricultural runoff.
https://symposium.foragerone.com/2021-racas/presentations/27397

Impact of Insulin-Reactive B Cells in Type 1 Diabetes

Makayla Windholz, *Biomedical Sciences*
Mentor: Maureen Banach

Abstract:
Autoimmune type 1 diabetes (T1D) affects millions of children and adults. In T1D, insulin is not produced due to the pancreatic beta cells being destroyed by diabetogenic T cells. Recent evidence demonstrates that another type of immune cell – B cells contribute significantly to the T1D onset. Although B cell depletion therapy is effective in delaying T1D progression in newly diagnosed patients, this treatment may
increase the risk of opportunistic infections, necessitating therapies targeting T1D-driving B cells. Particularly pathogenic are B cells that bind to insulin via a B cell receptor (BCR). A transgene of a component of the BCR VH125 heavy chain is useful in studying how B cells bind to insulin and how genetic background influences BCR binding. In this project, we used diabetes-susceptible non-obese diabetic (NOD) transgenic mice expressing VH125, termed VH125.NOD and diabetes-resistant B6.g7 transgenic mice also with the VH125 transgene, termed VH125.B6g7. Using these mice, we obtained insulin-binding B cells (IBCs) of low and high affinity to insulin from disease-relevant tissues: the spleen and pancreas. We hypothesize that the BCR repertoire of IBCs is different between the two transgenic
mouse strains impacting the disease development. To test our hypothesis, we characterized the BCR light chain repertoire in terms of V and J gene segment usage as well as the amino-acid composition of complementary determining regions (CDRs). We found that the V kappa 4 gene family is predominantly used in IBCs. The analysis of the CDR3 region revealed that the VH125.NOD IBCs contained more charged amino acids compared to the VH125.B6.g7 ones. The charge of CDR3 is important because it may facilitate binding to negatively charged insulin. To conclude, we demonstrated that BCR light chain repertoire varies between diabetes-susceptible and diabetes-resistant transgenic mouse models. These results may be important in therapies depleting specific B cell types.
https://symposium.foragerone.com/2021-racas/presentations/27190

Impacts on gut microbial communities following exposure to poly- andperfluoroalkyl substances (PFASs) from fire training area plumes in CapeCod, Massachusetts

Annarose Phelps, *Natural & Physical Sciences*
Mentor: David Bertolatus

Abstract:
The composition of gut microbial communities can have far- reaching effects on host physiology; however, little is known about the relationships between toxicant exposure, gut microbial communities, and host health. Per- and polyfluorinated alkyl substances (PFAS) are a class of persistent organic pollutants used in many applications. The objective of this study is to examine the effects of exposure to PFAS on the gut microbiome of fathead minnows (*Pimephales promelas*).
Adult fathead minnows were exposed to mixtures of PFAS from a contaminated groundwater plume on Cape Cod, MA, USA. Gastrointestinal tracts from exposed and control fish were dissected and DNA was extracted. Relative abundances of different operational taxonomic units (OTUs, or different types of bacteria) will be identified by 16S ribosomal gene sequencing. The relative abundance OTUs between the control and PFAS exposed treatment groups will be compared. This study will measure changes in the composition of gut microbial communities due to different doses of PFAS mixtures.
https://symposium.foragerone.com/2021-racas/presentations/27388

Improving Police Community Relations: Understanding Public Perceptions, Influences, & Facts

Jessica Valdez, *Social Sciences*
Mentor: Dr. Melissa Tackett-Gibson

Abstract:
Over the last decade, police-community relations have been strained due to perceptions that law enforcement officers targets minorities using lethal force excessively. To begin to rebuild police relationships within communities, it is necessary to understand how citizens truly feel about the police, the causes of police distrust, and how we can begin to change these perceptions. A review of multiple studies of policing indicates that race may not be the most significant factor affecting police-community relations, or perceptions of effective policing. Instead, perceptions about crime and safety were stronger predictors of how satisfied citizens were with the police and how common they thought police misconduct occurred in their neighborhoods. The mainstream media also contributes to public attitudes about law enforcement. It is a source of negative portrayals of the police - often without background information about use of force, police training, or data related to the frequency of use of force incidents. This bias has the potential to contribute to perceptions that use of force is common and that the police are racially biased. Studies on use of force showed no difference in decision making based on race. More realistic coverage, as well as policy changes to improve neighborhoods and reduce crime, a focus on community policing, and better training in de-escalation and predictors of potential lethal force situations can potentially aid in improving the police-community relationship. While research is still ongoing, this presentation will give an overview of the trends that the data collection has revealed to date. The influence of race, personal experiences with the police, and media consumption will be examined, and the ways in which we can begin to improve those perceptions.
https://symposium.foragerone.com/2021-racas/presentations/27265

In Memoriam: 1918/2020
Trevor Leach, *Arts & Humanities*
Mentor: Rian Kerrane

Abstract:
In Memoriam: 1918/2020 is an artwork, book, and memorial to the victims of the 1918 flu pandemic in Denver, exploring a universal experience through a regionalist perspective. With a visual style that reflects the Modernist art of the early 20th century, as well as the legacy of book arts from the medieval era, this project illustrates contemporary parallels to past human experiences by layering elements of visual art, literature, and nature. As an artist living through the 2020 coronavirus pandemic, the accompanying book for *In Memoriam: 1918/2020* investigates art historical connections to artists who lived through or died in previous outbreaks of disease like black plague and influenza. Pandemics like those in 1918 and 2020 often result from, as well as stir up, social change.
https://symposium.foragerone.com/2021-racas/presentations/26788

Integrated Solar Energy for Sustainable, Resilient, and Equitable Communities
Raven O'Rourke, *Technology, Engineering, & Mathematics*
Mentor: Serena Kim

Abstract:
As the cost of solar energy generation has decreased significantly, Colorado's electricity from renewable sources has more than tripled since 2005. However, there remains a gap in renewable energy deployment between metropolitan and non-metropolitan areas. This project aims to understand the geographical disparities in solar energy deployment, and to identify the socioeconomic and technological determinants of such disparities. Machine learning, which is a form

of artificial intelligence that enables a system to learn from data and perform complex tasks, such as classification and clustering, is used to estimate solar deployment rate and public opinion on solar energy. To obtain an accurate estimation of solar deployment, our team collected 660,000 high-resolution satellite images of Colorado. Using Convolutional Neural Network (CNN) image classification algorithms, we are identifying the number of solar panels present in all census blocks in Colorado. Additionally, Bidirectional Encoder Representations from Transformers (BERT), which is a state-of-the-art natural language processing algorithm are used to estimate public opinion on solar energy using over one million Twitter posts. These two machine learning-based approaches present huge opportunities for generating timely data on spatial disparities, as computers can analyze data much faster, with often higher accuracy, than humans. An important part of using a CNN is providing training data that the network can learn from. Part of my role has been categorizing satellite imagery based on the presence of solar panels, and this labeled data will be used to teach or test CNN's ability to identify the presence of solar panels. Based on the results of the image and sentiment analysis, Colorado cities and towns will be able to better identify the spatial gaps in solar deployment and public opinion across the neighborhoods.
https://symposium.foragerone.com/2021-racas/presentations/27482

Interpreting Data in the Search for Dark Matter
Arvind Srinivasan, *Natural & Physical Sciences*
Mentor: Anthony Villano

Abstract:
The Cryogenic Dark Matter Search (CDMS) is a collaborative effort to study Dark Matter through direct detection using cryogenic sensors. The goal of this effort is to determine the size, or more specifically, the cross-sectional area and mass of a Dark Matter Particle. The size impacts how the particle interacts with any test matter by changing the relative proportion of the interactions that interact with a nucleus (Nuclear Recoils) as opposed to the electron cloud (Electron Recoils). The sensors involved in Dark Matter detection measure charge energy (E_q) and phonon energy (E_p) for any given event. Thus in order to study the interaction, this project intends to create a mathematically accurate method of inputting sensor data for many recoil events and estimating the relative proportion of nuclear recoils with proper confidence interval.
https://symposium.foragerone.com/2021-racas/presentations/27460

Investigating Interdisciplinary Communication Strategies Used by Artists and Engineers in the 3D Animation Industry
Ryan Breuer, *Arts & Humanities*
Mentor: Dr. Arianne Collopy, Dr. Kristin Wood

Abstract:
Developing excellent communication skills is essential for any job or profession, but for animation it is what will determine if a studio functions at all. Two of the largest core specialized workers inside an animation studio are 3D artists and engineers, both of which come from different backgrounds and learn disparate communication strategies, skills, and vocabularies. While previous studies have looked into how engineers collaborate with artists, none have been done in the context of the animation industry-at-large or how artists collaborate with other engineering disciplines. Through this study, we aim to identify some commonalities and differences between communication strategies used by 3D artists and engineers in working with interdisciplinary co-workers in such an environment.
Through this study, we conducted a series of one hour interviews virtually with 3D artists, engineers, and colleagues that work with both disciplines in a variety of studios encompassing the 3D animation industries. Then, we transcribed the

interviews and used thematic coding and design thinking techniques to analyze the interviews and interpret our findings. Analytics were performed and agreed upon by multiple investigators in order to remove biases of opinion. Based on our initial results, we found that both artists and engineers find it crucial in a workplace to be able to take feedback from other coworkers well, regardless of industry. The type of feedback and how it is received or given can vary. We also discovered that many studios begin to form their own unique "language" in order for diverse teams to understand each other. By learning some interdisciplinary language from a variety of sources increases their collaboration. Finally, we found that almost all participants, regardless of position or background, agreed that the process of the animation "pipeline", or workflow, is an unspoken necessity for communication to function in a studio.
https://symposium.foragerone.com/2021-racas/presentations/27486

Investigating the Association Between Unique to Salmon Metabolites with Systolic and Diastolic Blood Pressure
Mobin Khajeh-Sharafabadi, *Technology, Engineering, & Mathematics*
Mentor: Dr. Audrey Hendricks

Abstract:
The effect of diets on human physiology has always been an area of interest for researchers. Many researchers are focusing on identifying a possible association between specific diets and health outcomes, such as correlation between systolic or diastolic blood pressure and heart disease. While numerous studies have shown a relationship between diets such as the Mediterranean or Western diet and health, there is often uncertainty relating to which specific foods or food combinations are associated with health outcomes. In this study, we investigate the relationship between specific foods in the Mediterranean diet using an untargeted nutritional metabolomics dataset from a pre-existing crossover designed study. For this study, we limit our focus to 28 compounds that are found only in salmon but not in 19 other foods that are also found in samples of plasma from people who have consumed salmon. Linear mixed effects regression was used to assess the association between unique salmon metabolites and blood pressure. We find that presence of the compounds in plasma occurs more often after than before consumption of salmon.
https://symposium.foragerone.com/2021-racas/presentations/27369

Investigating the Role of Fibronectin Binding Proteins in MRSA Colonization of the Female Reproductive Tract
Laurie Lyon, *Biomedical Sciences*
Mentor: Alexander Horswill and Kelly Doran

Abstract:
Staphylococcus aureus is an opportunistic pathogen that can cause a wide-range of diseases, from acute skin infections to life-threatening soft-tissue infections, endocarditis, sepsis, and osteomyelitis. The main reservoir for *S. aureus* in humans is the anterior nares, but the vaginal tract has recently been recognized as a significant reservoir with nearly 25% of women colonized. Though *S. aureus* vaginal colonization is often asymptomatic, it has been linked to aerobic vaginitis, skin and soft tissue infections (SSTIs) of the anogenital region, and toxic shock syndrome. *S. aureus* is also known for its ability to gain antibiotic resistance, leading to epidemic waves caused by a small number of successful clones, such as the hypervirulent methicillin-resistant *S. aureus* (MRSA) strain USA300. This strain has also become the dominant MRSA strain to vaginally colonize pregnant and postpartum women in the US. For this reason, we use USA300 to explore how S. aureus colonizes the female reproductive tract (FRT). *S. aureus* adhesins are of particular interest because they mediate initial attachment to epithelial cells and extracellular matrices as well as biofilm formation. We have shown that a USA300 multi-mutant lacking several adhesins displays significantly attenuated adherence to FRT epithelia and murine FRT colonization. Using in vitro bacterial adherence assays, I have identified fibronectin binding proteins (FnBPs) as the key USA300 adhesins mediating attachment to vaginal cells. FnBPs have been shown to mediate

attachment and invasion in other cell types by binding to host cell α5β1 integrin by fibronectin bridging, and they have been shown to promote USA300 biofilm formation and aggregation in vitro. This project seeks to investigate the mechanism of FnBP binding to cells of the FRT, whether FnBPs allow S. aureus to form biofilm-like clusters on cell surfaces during FRT colonization, and the relevance of these proteins to FRT colonization in vivo.
https://symposium.foragerone.com/2021-racas/presentations/26740

Irish Domestic Servants in 19th Century Colorado
Emma Lawrence, *Arts & Humanities*
Mentor: James Walsh

Abstract:
In the 19th century, there was a significant increase in Irish emigration to America, spurred in large part by conditions of poverty, famine, and lack of opportunities at home. And alongside the storied immigrant miners and railway laborers of this period came a number of usually unmarried women and girls. In search of better economic and social prospects, these women often sought work as domestic servants in wealthy American homes. Extant research on Irish domestic servants has tended to focus most heavily on those who lived and worked in the Eastern U.S. However, by the mid-late century, Irish immigrant populations were increasing rapidly in Colorado as well. Therefore, efforts to uncover the historical lives of local domestic servants can potentially offer a complementary yet distinct understanding of who they were and what they did. Using census, newspaper, and other forms of archival records, this project charts, maps, and identifies understudied realities of Irish servant life in the state of Colorado during a formative period from 1870-1890. Analysis of these resources has revealed salient information about 1st and 2nd generation Irish domestic servants, including but not limited to: where and when they worked and lived, their day-to-day experiences, their religious and community involvements, their movement and migration patterns from Ireland as well as within the U.S. and Colorado, the challenges that they faced in their occupations, and some of the ways in which they might have experienced life differently from their East Coast counterparts.
https://symposium.foragerone.com/2021-racas/presentations/27477

JT Gamer Values Theory- Why do people play Video-Games?
Jacob Torrens, *Social Sciences*
Mentor: Dr. Vicki Lane

Abstract:
Esports is a non-traditional sport form that generated just under $1.2 billion in revenue as an industry in 2019. While conversation and news media coverage of esports (i.e. organized competitive video gaming) has considerably increased since 2016, many non-endemic, traditional consumer brands have resisted capitalizing on esports brand-building opportunities. Although appearing in limited consumer brand values research, the use of esports by established consumer brands has not been emphasized in the marketing and sport marketing literature. This research presents an overview of the JT gamer typology theory. It discusses the nature of different types of gamers and features that are common to all gamer types and what distinguishes one value from another. The theory identifies three basic types of gamers that can be recognized across all games. At the core of the theory is the idea that the gamer constructs form a pyramid structure that reflects a combination of motivational values. This pyramid structure captures the conflicts and compatibility among the three-gamer type paradigm. The methodology taps into the picture metaphor research technique, attribute-to-value representation, and analysis. The findings reveal substantial differences in gamer motivations that differ depending on the situation. However, common attributes, such as what game is being played,

can alter what gamer type motivational values will be expressed. The last section of the research will discuss gamer meaning transfer and virtual bullying.
https://symposium.foragerone.com/2021-racas/presentations/27293

Kir2.1 Potassium Channels and Bone Morphogenic Proteins in Craniofacial Development
Karli Swenson, *Biomedical Sciences*
Mentor: Emily Bates

Abstract:
KIR2.1 POTASSIUM CHANNELS AND BONE MORPHOGENIC PROTEIN IN CRANIOFACIAL DEVELOPMENT. KS Swenson , Y Ozekin, T Isner, E Bates, Department of Pediatrics, University of Colorado | Anschutz Medical Campus, Aurora, CO.
Craniofacial development relies on signaling molecules such as Bone Morphogenic Protein (BMP). It has become apparent that ion channels are also critical for craniofacial development. However, how ion channels contribute to canonical developmental signaling remains mysterious. Loss of the K^+ Inwardly Rectifying Channel Kir2.1 (*Kir2.1*$^{KO/KO}$) phenocopies loss of BMP2/4 signaling from the cranial neural crest cells (cNCCs) of mice. Kir2.1 is also required in the cNCCs for secondary palate closure. Furthermore, BMP signaling is reduced in the developing palate of *Kir2.1*$^{KO/KO}$ mice. To understand how Kir2.1 contributes to BMP signaling, we knocked out one copy of Kir2.1 and turned on a constitutively active BMP receptor in the cranial neural crest. We then quantified changes in craniofacial development. In *Kir2.1*$^{KO/+}$ mice that express a constitutively active BMP receptor (*caBMPR1a/+*) in the cNCC, we found an exacerbation of phenotypes including a shortened premaxilla, shortened nasal bones, widened fontanelle, and decreased mandible height and length. Data from our lab shows that depolarization can induce BMP4 release. Loss of Kir2.1 should depolarize cells and could lead to a constant release of BMP4. Together, these results suggest a negative feedback loop in BMP4 signaling in which constant release of BMP4 is detrimental to the efficiency of BMP4 signaling.
https://symposium.foragerone.com/2021-racas/presentations/27416

Left Behind in Lockdown: COVID-19 and the Denver Unhoused Community
Lucy Briggs, *Social Sciences*
Mentor: Kirsten Christensen

Abstract:
The population experiencing homelessness in Denver, Colorado, increased by nearly 15% from 2018 to 2019 (MDHI, 2020). This trend, combined with the SARS-CoV-2 pandemic of 2020, led to a distinct crisis nationwide among populations experiencing homelessness. As the COVID-19 virus hit Denver in the spring, the State instituted "stay-at-home" orders in an attempt to control the virus. What did a stay-at-home order look like for those without one? Previous research addressed several aspects of COVID-19 and homelessness: (1) Individuals experiencing homelessness are more socially vulnerable to hazards such as pandemics (Finnigan, 2020, Ritchie, 2020), (2) encampments may be safer than shelters in terms of COVID-19 spread, (Bryson, 2020, Susman, 2020), and (3) displacement of encampments have significant impacts upon the health and behavior of unhoused individuals (Westbrook & Robinson, 2020; Langegger & Koester, 2017). Existing literature gives a full picture of the displacement of encampments in Denver and the impacts of COVID-19 on unhoused individuals; however, it does not include thorough documentation on the intersection between these two experiences. Additionally, there is a notable lack of GIS data of encampments, shelters, services, and geographic movement.
This thesis strives to answer the question, “How has COVID-19 impacted the locational strategies and spatial patterns of the Denver unhoused population in relation to the services of the city core?”
https://symposium.foragerone.com/2021-racas/presentations/27257

Leonora Carrinngton Occultism and Religous Myths
KelsI Berumen, *Arts & Humanities*
Mentor: Maria Buszek

Abstract:
Throughout my oral presentation, I will address the surrealist paintings of Leonora Carrington and how her surrealist connections allowed her to make connections between her personal life and her religious interests. I will look at how she uses certain symbols such as labyrinths to show how she combined them with her personal interest and religious interests. Labyrinths are not the only symbols she uses in her paintings she also pulls from witchcraft or occults, such as table settings and groups around tables were a vital symbolic ritual that she used in many of her paintings. Carrington would also use several Egyptian symbols such as lotus flowers and several of her paintings. My hope throughout my presentation is to show how Carrington used surrealist ideas and her personal interest and religious interests to create her paintings.
https://symposium.foragerone.com/2021-racas/presentations/27433

Leviiatha
Eric Rogers, Crystal Lee, *Arts & Humanities*
Mentor: Michelle Carpenter

Abstract:
Leviiatha is a senior thesis production project from the Digital Animation Center of CU Denver that utilizes Unreal Engine 4 to tell an immersive and interactive story.
The story is that of a young woman researching a cure for a deadly illness that plagues the entire universe. It takes place on a planet where “aquatic” creatures “swim” through “seas” of fog below. This researcher believes that the key to the cure is within one of these creatures, a siiren, which she can’t even confirm exists. We the player experience this story through the sister of this researcher, Kaia. As we explore this ominous planet, we discover just how far our sister is willing to go to achieve her ends, and exactly what she’s willing to sacrifice.
Leviiatha is made with Unreal Engine 4, a realtime render engine that utilizes cutting edge technology that’s very accessible and easy to use for artists. This technology allowed the *Leviiatha* team to work on their art in iterations, which we feel was a pivotal process in our team’s success. In this presentation, we’ll talk about how our project came to be, how UE4 enabled us as artist to be more efficient, and how important working iteratively was to our creative process as students.
https://symposium.foragerone.com/2021-racas/presentations/27503

Longitudinal Research on Aging Drivers (LongROAD)
Brandon Josewski, *Social Sciences*
Mentor: Dr. Carolyn DiGuiseppi

Abstract:
Background
Driving maintains mobility and supports the social and emotional welfare of older adults. However, since older adults make up a disproportionate share of all driving-related deaths, it is paramount to investigate their safety needs.

Personal Objectives
I am working as a research assistant (RA) on the LongROAD study, which is collecting data from older drivers annually for 5 years to understand and make recommendations about their driving safety needs.

Methods
I learned the logistics of sampling through a healthcare system and its potential for associated biases. I completed extensive training in (1) protection of human subjects and privacy, and research electronic data capture to uphold the validity of the study while working with human participants and (2) administration of the LongROAD questionnaire. I conducted 45 of 127 (35.4 %) 5th-year follow-up visits. Throughout, I applied methods to ensure accurate data collection and high retention in a longitudinal study. Some challenges that we faced due to COVID-19 were (1) the fact that we only conducted telephone visits, losing out on 4th-year follow-up data such as the vehicle inspection and in-person functional assessments (2) the difficulties associated with troubleshooting a smartphone-based method to record GPS driving data over the phone with older adults, and (3) the remote environment reducing interpersonal team interaction.

Conclusion
I have expanded my understanding of how research is conducted, putting much of my undergraduate knowledge as a pre-medical student into practice. A release of the cumulative data after 5 years will occur, allowing other researchers to further analyze it. Our strategic partnership with AAA will allow for the dissemination of the study results to inform efforts to address the safety needs of older adult drivers. Examining the changing safety needs and driving patterns as a result of COVID-19 is another future application of the study.
https://symposium.foragerone.com/2021-racas/presentations/27359

Lynx Creative Collective
Jacob Garland, Erin Chang, *Arts & Humanities*
Mentor: Travis Vermilye

Abstract:
Lynx Creative Collective is a CU Denver student organization sponsored by the College of Arts & Media and funded by the Dean's Student Innovation Award. It is our organization's mission to bring together the creative forces that span across the college with the goal of producing a high-quality print and digital publication, while fostering an engaged community established on inclusivity and diversity.

The publication serves the college as a way to showcase all students' work under one entity while aligning with the greater CU Denver's initiatives. Within the publication, you'll find 50+ interviews showcasing works such as digital art, illustration, animation, 3D rendering, film, music, advocacy and among others. This organization is committed to uplifting underrepresented communities on our CU Denver campus, educating, strengthening and advocating through guest lectures hosted by Lynx Creative Collective.

Lynx Creative Co. has two major initiatives, the first is to give the members of the organization the chance to work in a cross-disciplinary environment that encourages creative collaboration, real-world professional experience, and the opportunity to apply their major. Lynx Creative Co. is a unique opportunity for students to engage with other creative individuals to work towards a collective goal of launching, producing and sustaining a digital publication.

The second initiative is to give students at CAM the opportunity to showcase their work in the digital publication while receiving press, media and marketing training. We aim to encourage contributing students the opportunity to gain the confidence to present work online and begin to acquire a digital presence. We also offer contributors the chance to take part in artist features and interviews to gain publicity in the local and greater Denver community.

Lynx Creative Collective believes activism and advocacy starts in your community and goes offline. Beyond being a digital publication, we have decided to produce a high quality, physical publication using creative printing processes that have allowed us to showcase students' work to the highest degree. Along with the printed publication, we have created an entire press package to elevate the Lynx Creative Collective experience and leverage the organization's mission.

We are honored to be a recipient of the 2020 Dean's Student Innovation Award, which has allowed us to realize the organization's full potential. We have applied the award funds to pursue a physical print publication and develop additional marketing materials. It is our goal to develop a diverse collaborative environment on the CU Denver campus for participating students to safely express their creativity.
https://symposium.foragerone.com/2021-racas/presentations/27635

Maa || Documentary
Christopher Riggs, Jazmine DiGiorgio, Taylor Neumann, Maddy Santamaria, *Arts & Humanities*
Mentor: Roma Sur

Abstract:
Filmed over the past two years in Kolkata, India; Ontario, Canada; and Denver, Colorado, "*Maa*" is a documentary film following a fatigued septuagenarian on her road to realizing her dream of gazing upon Niagara Falls before her last breath. Inspired by films like "*The Architect*" (2016), the film's narration comes from her daughter's perspective. It is a testimony to the cross-cultural collaboration between the Satyajit Ray Film Institute of Kolkata and CU Denver, creating an intersection between these two worlds that enhances the learning potential in how composition, color, editing, and sound influence a story through perceived cultural emotions. Growing up in a world that condemns female independence, this character study explores what it means to cast aside societal norms in India and reclaim one's independence while raising a family as a single mother. Maa's health is debilitating; her ability to walk is slowly withering away. Her knees bowed, and her hands shriveled. Her eyesight is weak, yet she remains an avid reader. As the film progresses, it begins to delve into broader, more universal themes touching on depression through the lens of loneliness and the influence that spiritualism and human connection have on a person. It is a story about mothers celebrating the strength of living alone at eighty with a fierce optimism draped in hope in a post-modern era. On March 22, 2020, the West Bengal Government declared a lockdown due to COVID-19, shifting the documentary's entire tone and the Falls metaphor to that of her loved ones who elude her in an unrelenting pandemic. As Maa's health deteriorates, so do her chances of seeing the Falls. Have her chances of reuniting with her daughter, who immigrated to the U.S., slipped away? As the film concludes, the fight has left Maa. Her lust for life has been swept away by the fury of the pandemic. Forced into further isolation and unending grief, "*Maa*" is a testament to the year 2020 and the hardships of years past, which challenged the human spirit in ways not yet known to us. Lives transformed as lives were lost and destinies changed—"*Maa*" witnesses all of that through the landscape of cinema.
https://symposium.foragerone.com/2021-racas/presentations/27245

Mile High Punk: The Front Range Punk Scene of the Late 1970s
Keira Richards, *Arts & Humanities*
Mentor: Rachel Gross

Abstract:
"Mile High Punk" is a study of the motivations, participants, and impact of the Punk scene of the Colorado front range from its advent in the late 1970s through the 1980s. Colorado had a small but significant punk scene late is largely

ignored in the cultural narrative of the region as well as the wider study of Punk culture. This project seeks to study the Colorado scene within the context of the global punk music and the history and climate of Colorado. The project is presented via a website with the goal of a full article by the end of 2021.
https://symposium.foragerone.com/2021-racas/presentations/30209

Mindfulness, Prosocial Behaviors, and Emotional Processing
Emerald Saldyt, Esmeralda Lopez, Katie Feldt, *Social Sciences*
Mentor: Dr. David Albeck

Abstract:
BACKGROUND AND AIMS: The goal of this study is to advance the understanding of variability in emotional reactivity based on individual differences. Generally, people tend to react more intensely to negative than to positive or neutral affective images. However, those with more meditation experience and trait mindfulness have been found to be less reactive to negative images, while those with high trait empathy and altruism tend to be more reactive. Practicing meditation can increase mindfulness, empathy and altruism. The goal of this study is to examine individual differences in subjective emotional reactivity to affective images.
METHODS: Data was collected using an online survey. Participants included students at the University of Colorado Denver and meditators recruited from meditation groups across the United States. Data on meditation experience was collected as well as mindfulness, altruism, and empathy using established self-report measures. Emotional reactivity was assessed using the Self-Assessment Manikins Scale in response to images selected from the International Affective Picture System.
RESULTS: Composite mindfulness, as well as sub-scale scores on *Observing* and *Non-reactivity* factors of mindfulness, are significantly related to decreased reactivity to positive emotional stimuli. Those who score higher on empathy rate negative images as more negative and report higher arousal to negative stimuli, while those with higher levels of *Non-judging of Inner Experiences* are less reactive to negative stimuli.
CONCLUSIONS: Our findings indicate that mindfulness, and certain components of it, are significantly correlated with the ability to notice and adaptively regulate one's emotional response to affective stimuli. This is important for understanding how individual traits may modulate emotional reactivity and open avenues for using meditation to increase prosocial behaviors and train adaptive emotional coping strategies.
ACKNOWLEDGEMENTS AND FUNDING: This study has been funded by the Undergraduate Research Opportunities Program at the University of Colorado Denver.
https://symposium.foragerone.com/2021-racas/presentations/26831

Molecular Docking and Analysis of Dimethylbiguanide on Pyruvate Carboxylase in silico
Vrishank Bikkumalla, *Natural & Physical Sciences*
Mentor: Dr. Jefferson Knight Ph.D and Dr. Scott Reed Ph.D

Abstract:
A key sign of type II diabetes is the upregulated metabolic process of gluconeogenesis, the process by which the body produces glucose. As such, gluconeogenesis can be a target of a variety of different anti-diabetic drugs, including a drug called dimethylbiguanide. One of the enzymes of gluconeogenesis is pyruvate carboxylase. Previous work has suggested potential inhibition of pyruvate carboxylase by dimethylbiguanide; however, specific interactions are unknown. In this study, in silico molecular docking techniques were used to determine 1) whether dimethylbiguanide bound to the catalytic active site and 2) determine the energetics and the specific forces involved in the interaction. The known structure of human pyruvate carboxylase was chosen for these docking studies on the basis of its sequence alignment

with the bovine enzyme that is typically used in biochemical experiments. After this, the programs Autodock Vina & SwissDock were used to determine possible binding locations, orientations, & energetics. BIOVIA Discovery Studio Visualizer was used to visualize the hydrogen-bond and hydrophobic interactions of dimethylbiguanide with the enzyme. These characterizations were then compared to the energetics and interaction forces of the pyruvate and biotin substrates of pyruvate carboxylase. Overall, our results suggest whether there is an interaction between pyruvate carboxylase and dimethylbiguanide and what specific amino acid residues are involved. This study furthers scientific knowledge on dimethylbiguanide's targets and opens further inquiry into the interaction in vitro.
https://symposium.foragerone.com/2021-racas/presentations/26471

Neural measure of visual attention's effect on long term memory
Nicolette Vere, *Social Sciences*
Mentor:

Abstract:
Every day we encounter millions of objects but many of them are not remembered. What factors determine which are remembered and which are not? Literature shows that we remember visual details of many objects without trying, known as incidental memory (Williams, Henderson, & Zacks, 2005). That said, other research has shown that the type and amount of attentional allocation modulates what is later remembered (Sasin & Fougnie, 2021). However, limited research has been done to examine if neural measures of visual attention can be used to predict successful encoding to long term memory. We plan to study the importance of visual attention on long term memory encoding through a study that records EEG data from participants as they complete an irrelevant encoding task. During this first task, participants will be shown pictures of two images within circles that have varying border thickness and asked to identify which side of the screen the thicker circle is on. In an unexpected second memory task, we will ask participants which images from earlier they accurately remembered. We will then look at the event-related potentials from encoding, separately for images that were later remembered and those that were not. Specifically, we will examine the N2pc, a component that indicates spatial selection, to see if attentional allocation during encoding is related to later memory status. We predict that images that were inside of target circles will be better remembered (Sasin & Fougnie, 2021). This presentation will contain relevant background literature, planned methods, and hypothetical data.
https://symposium.foragerone.com/2021-racas/presentations/27167

Neural Mechanisms of Exercise-Induced Stress Resilience In Females
Troy Hubert, *Biomedical Sciences*
Mentor:

Abstract:
Inescapable stressors are associated with the onset of stress-related disorders, such as depression and anxiety. Despite the fact that the incidence of stress-related disorders is higher in females than males, there has been less research on the mechanisms underlying stress disorders and stress resilience factors in females. One sex difference in stress resilience seems to be that female rats are more responsive to the stress-buffering effects of exercise than males. Specifically, while six weeks of voluntary exercise can protect male rats from the anxiety- and depression-like behavioral effects of inescapable stress, only 3 weeks of exercise is required to enable similar stress resilience in females. Excessive activation of serotonergic (5-HT) neurons within the dorsal raphe nucleus (DRN) is largely responsible for the anxiogenic and depressive behaviors following inescapable stress. In male rats, exercise enables stress resilience by constraining activation of these stress-promoting DRN 5-HT neurons. However, whether a similar mechanism underlies the rapid stress resilience produced by 3 weeks of exercise in females is unknown. The goal of the present study is to determine if

both 3 and 6 weeks of voluntary exercise constrains activation of DRN 5-HT neurons during exposure to inescapable stress in females. Double-label immunohistochemistry is being used to label DRN 5-HT neurons and mark their activity with the neural activation marker, cFos. Data collection is ongoing. Results of this study have to potential to reveal novel, fast-acting, and potentially sex-specific targets of stress resilience.
https://symposium.foragerone.com/2021-racas/presentations/27502

Neuroimaging Characteristics of Transgender Men and Women: A Systematic Literature Review
Michael Millan, *Biomedical Sciences*
Mentor: Jennifer Hranilovich

Abstract:
Aim: This systematic literature review was conducted to identify, evaluate, and characterize the different methods and results of structural and functional brain studies on the characteristics of transgender individuals. **Materials and Methods:** Studies published in the English language between 1990 and 2021 will be retrieved from PubMed database using the search strategy of MeSH terms that were relevant: neuroimaging, transsexualism, and headache. The articles that have applicable MeSH terms will be pulled from PubMed and will be reviewed to determine the applicability of articles to the systematic literature review being conducted. To determine the applicability of an article, the author will cut out inapplicable articles and a second reviewer will agree or disagree with the list of cut articles. If the author and second reviewer disagree then a third reviewer will be the tiebreaker and determines the applicability of the article. **Research limitations:** The methodology of using MeSH terms for one database does not guarantee that all publications that are related to the research being conducted are pulled. **Originality/value:** To the best of the authors' knowledge, a thorough search and variety of MeSH terms were used to pull all possible articles that are applicable to the systematic literature review being conducted.
https://symposium.foragerone.com/2021-racas/presentations/27469

Neurological Differences in Sex Chromosome Aneuploidy
Jonathan Platt, *Biomedical Sciences*
Mentor: Jennifer Hranilovich, MD

Abstract:
Background: Sex chromosome aneuploidy is a common defect that affects 1/400 births. This condition involves an abnormal copy number of the X or Y sex chromosome, which may affect both physiological and neurological development. The two most common aneuploidies are monosomy X (Turner) or XXY (Klinefelter).
Objectives: To understand neurological differences between these two aneuploidy conditions compared to typically developing adolescent and pediatric populations, a systematic review was conducted on relevant material.
Search strategy: PubMed was used in December 2019 as the source for journals used in this review.
Selection criteria: Journals were gathered using a matrix consisting of concepts, free text, and Medical Subject Headings (MeSH) phrases. Both sex chromosome aneuploidy and MRI were used as the concepts. The free text consisted of Klinefelter, Turner, and MRI along with any abstract meaning. MeSH phrases included Klinefelter syndrome, Turner syndrome, tetrasomy, and magnetic resonance imaging.
Data collection and analysis: Any journal that matched this matrix in PubMed was uploaded into Covidence to start the initial abstract round. This round consisted of an undergraduate researcher and the author reading only the abstract using a set of approved exclusion and inclusion criteria for initial voting. After this initial round, each journal was read in its entirety to determine if the publication's content met the set criteria. In the final round, each journal is reread by

both researchers to extract relevant information. This information is then collected using an online survey software called RedCap to organize the collected neurological results from each journal.
Current results: From the 220 journals pulled from PubMed, 168 were voted irrelevant in the initial abstract screening. After a full review of the 52 remaining studies, 43 had been relevant and included.
Next Steps: Using RedCap, the 43 journals will be dissected, followed by a meta-analysis on these findings.
https://symposium.foragerone.com/2021-racas/presentations/27468

Non-enzymatic post-translational modification of lysine clusters in C2 domains
Cisloynny Beauchamp-Perez, *Biomedical Sciences, Natural & Physical Sciences*
Mentor: Jefferson Knight

Abstract:
C2 domains are membrane-binding motifs found in a wide range of proteins involved in signal transduction and membrane trafficking, including key proteins in neurotransmitter and hormone secretion. A large subset of C2 domains bind membranes containing the signaling lipid, phosphatidylinositol-(4,5)- bisphosphate (PIP2), via a conserved cluster of lysine residues. Because lysine residues can be non- enzymatically modified by reactive compounds such as lipid aldehydes formed during oxidative stress, we are investigating the susceptibility of C2 domain lysine clusters to modification by carbonyl-containing compounds. Previous research has shown that synaptotagmin-like protein 4 (Slp-4), a C2 domain protein, becomes carbonylated in alcoholic liver disease. Our *in vitro* results using the purified protein domain indicate that the lysine cluster is among several sites that react with the lipid aldehyde 4-hydroxynonenone, a major byproduct of cellular oxidative stress. Furthermore, when expressed in *E. coli*, some of the expressed Slp-4 C2A domain becomes phosphogluconoylated at the lysine cluster, a nonenzymatic modification that is normally found only at the low-pKa amino termini of His-tagged proteins. Using mass spectrometry, Western blotting, and cation exchange chromatography, we are now seeking to if the most reactive residue is indeed contained in the lysine cluster. Further investigation will include the study of other highly reactive metabolites and their reactivity towards C2 domain containing proteins. Nonenzymatic damage to secretory proteins as a result of oxidative stress represents an underexplored possible mechanism for deterioration of secretory pathways in diseases of exocytotic cells.
https://symposium.foragerone.com/2021-racas/presentations/27467

Non-Photorealistic Rendering Research and Development in Blender
Davis-Jay Harris, *Arts & Humanities*
Mentor: Arianne Collopy

Abstract:
Computer-generated (CG) graphics have become standard in many industries over the last decades, from medical fields, technology development, data visualization, and multimedia art in film and games. CG artists have the ability to create three-dimensional (3D) objects and apply textures that visually represents the material of the model. These textures can be image-based, meaning images are mapped onto a 3D object, or value-based, meaning color and light profiles are mapped to a 3D object. The final rendering process transforms a 3D scene, with every texture, color, and light profile for each object, into a 2D representation. Photorealism has been the driving force behind CG graphics since its inception, emphasizing rendering that mimics photographic quality and realistic textures. Non-photorealistic rendering (NPR) in contrast emphasizes rendering that mimics the aesthetics of traditional, handcrafted illustrations. NPR has been adopted as a CG art practice allowing exploration of a wide range of expressive digital art styles. Though most studio-produced CG art is photorealistic, NPR is more accessible than ever before because of software advances and inclusivity of the CG artist community across amateurs and professionals. This opens new opportunities to produce stylized

graphics inspired by the wide range of handcrafted art styles, both purely visual art as well as images inspired by traditional art through non-photorealistic rendering. My study uses a Design Innovation process to investigate and develop methods in Blender a) to produce shaders that mimic inked outlines and painterly textures, as well as b) other digitally-based effects for non-photorealistic rendering. I will also make comparisons to previous art movements in art history, and discuss NPR's relevance to modern digital art. With the addition of my research, I hope to provide a resource for novice and professional artists to study and practice non-photorealism, as well as create stylized CG projects in new ways.
https://symposium.foragerone.com/2021-racas/presentations/27472

Optimizing COVID-19 Vaccine Allocations in Denver
Sandra Robles Munoz, *Data-to-Policy Project*
Mentor:

Abstract:
The world has been under the grip of the COVID-19 global pandemic for more than one year. With the advent of Sars-Cov-2 vaccines, the US needs to vaccinate as many people as possible to reduce risk of severe illness to immunocompromised populations, as well as to start the path forward to normalcy. In this project we investigate convex optimization techniques to improve vaccine allocation to the county of Denver in such a way that distribution is optimized for demand for the vaccine. We attempt to optimize this allocation based on availability of service providers, their capacity, as well as by trying to ensure equitable distribution of vaccines amongst Denver's disadvantaged and minority populations. Our hope is that by explicitly accounting for the needs of a given census tract, whether by considering its minority population or its proportion of unvaccinated, we can achieve herd immunity quickly and fairly.
https://symposium.foragerone.com/2021-racas/presentations/27522

Pathways Linking Health Literacy to Health Outcomes in Young Adults with Type I diabetes: A Cross-Sectional Survey Study
Yami Mendoza, *Social Sciences*
Mentor: Dr. Jonathan Shaffer

Abstract:
Hispanic/Latino individuals experience one of the lowest health literacy rates and have the highest diabetic rates in the U.S. compared to non-Hispanic Whites, African Americans, and Asian Americans. The public health significance of these rates is considerable given that this population is increasing in the U.S. There are conflicting findings on the association of health literacy and glycemic control, and the mechanisms underlying this association remains less clear. Our research tests aspects of the Pasache-Orlow & Wolf conceptual model, which proposes that three factors, (1) the use and access of health care, 2) the relationship between a patient and a doctor, and 3) self-care, mediate the association of health literacy with predicted health outcomes. Using a cross-sectional study design, 30 patients (18-25 years) were recruited from the Barbara Davis Center for Diabetes. Participants will use Qualtrics to complete Spanish or English versions of health literacy and proposed domain questionnaires. HbA1c levels will be collected from participants' medical records as our health outcome. Bivariate correlations and statistical analyses of mediation will be examined. We hypothesize 1) participants' self-reports and data from their medical records will show low health literacy is associated with higher HbA1c levels, and 2) the proposed mechanisms will explain the association between low health literacy and elevated HbA1c levels among Hispanic/Latino young adults with Type 1 diabetes. Our study serves to future interventions for this growing population, as well as guides providers and the health care system of the role of routinely assessing health literacy.

https://symposium.foragerone.com/2021-racas/presentations/30490

Pathways Linking Health Literacy to Health Outcomes in Young Adults with Type l Diabetes: A cross-Sectional Survey Study

Yami Mendoza, *Biomedical Sciences, Social Sciences*
Mentor: Dr. Jonathan Shaffer

Abstract:
Hispanic/Latino individuals disproportionally experience one of the lowest health literacy rates and have the highest diabetic rates in the U.S compared to non-Hispanic Whites, African Americans, and Asian Americans. The public health significance of these high rates of low health literacy and diabetes is considerable given that the Hispanic/Latino population is increasing. The association of health literacy with health outcomes such as glycemic control in Hispanic/Latino individuals with diabetes has often been demonstrated, but the mechanisms underlying this association remains less clear. Our research tests aspects of the Pasache-Orlow model of health literacy and health outcomes, which proposes that three factors, (1) the utilization and accessibility of health care, 2) the relationship between a patient and a doctor, and 3) self-care, mediate the association of health literacy with predict health outcomes. Using a cross-sectional study design, we will recruit 30 adult (<=18 years) patients from the Barbara Davis Center for Childhood Diabetes. Participants will use Qualtrics to complete Spanish or English versions of measures of health literacy (Short Test of Functional Health Literacy in Adults (S-TOFHLA)), the provider-patient interaction (Patient-Doctor Relationship Questionnaire (PDRQ-9)), self-care (Diabetes Self-Efficacy Scale (DSES); Diabetes Self-Management Questionnaire (DSMQ)), and navigation skills (Wayfinding Questionnaire). HbA1c levels, our primary health outcome, will be collected from participants' medical records. Bivariate correlations among all variables will be examined in addition to statistical analyses of mediation. Data will be used to determine the sample size needed for a fully powered study. Although cross-sectional studies do not permit casual inferences, our sample size may not be sufficient to detect statistical significance, and limited comprehension may hamper the quality of self-report data, our study represents an important first step in testing whether the Pasache-Orlow model explains the literacy-outcomes association.
https://symposium.foragerone.com/2021-racas/presentations/27330

PeaceXchange: A Platform To Act Locally And Impact Globally

Polo Aguirre, *Arts & Humanities*
Mentor: Martin Widzer

Abstract:
Creating a Platform to Educate International Issues
Many schools and news outlets lack international coverage, and this raises a concern since every country struggle with conflicts daily. This causes a global issue since as long as people stay unaware of these conflicts, there will be no resolution or support to end them. Due to this global issue, PeaceXchange was established. PeaceXchange is meant to be a platform to educate many on international issues with hopes to create and unite a generation of people who are educated to resolve these conflicts This is done through country profiles that educate conflicts regarding the country, insight magazines that cover a variety of topics, user create blogs where individuals publish personal experiences, and events where participants can chat and engage in topics regarding certain conflicts. The future of this platform depends on its growth and interest, and based on how many participated in the first PeaceXchange event, there is enough interest to maintain the platform and in the future expand to reach a larger audience.
https://symposium.foragerone.com/2021-racas/presentations/27479

PeaceXchange: Act Local, Impact Global
John Mazzetta, *Arts & Humanities*
Mentor: Martin Widzer

Abstract:
PeaceXchange is committed to the education of youth in peaceful dialogue, negotiation, and conflict resolution. Providing online and in-person resources, PeaceXchange assists in the education of the next generation of peace builders. By educating youth on conflicts and methods for sustainable conflict resolution, PeaceXchange aims to increase the number of youth participating in their communities, leading dialogue sessions and working towards a common goal of a more peaceful world.
https://symposium.foragerone.com/2021-racas/presentations/27438

Permitting a Better World: Revisions to the SeaTac Zoning Code to Improve Affordable Housing and Increase Equality
Grace Amundsen Barnkow, Britani Rudolph, Jordan Stopak-Behr, *Social Sciences*
Mentor: Serena Kim

Abstract:
The current Zoning Code in the City of SeaTac, Washington does not provide sufficient affordable housing and perpetuates racial and class-based inequalities. This issue permeates several aspects of how the City functions and, as the policy currently stands, it does not prioritize equality, alleviate homelessness, or help to reduce high traffic density, which are related concerns of the primary issue. In an effort to provide a recommendation for a solution to this problem, this policy memorandum includes eight distinct sections that cover:

- The policy problem, which explores the identified problem in detail.
- How the policy can be framed through a conceptualization of government and market failures.
- Seven policy goals that are used to evaluate the proposed policy alternatives.
- Four policy alternatives that are advanced and discussed in detail.
- A comprehensive assessment of the four alternatives using the policy goals.
- A consideration of the trade-offs that summarizes the main positive and negative factors of the alternatives as they relate to the policy goals.
- Limitations, which reviews the shortcomings of the memorandum and proposed policy solutions.
- The final recommendation on what policy alternative (residential infill) should be selected to alleviate the policy problem.
https://symposium.foragerone.com/2021-racas/presentations/22855

Peroxisome proliferator activated receptor gamma (PPARg) expression and vascular remodeling in preeclampsia
Kori Baker, *Biomedical Sciences*
Mentor: Colleen G Julian

Abstract:
Peroxisome proliferator-activated receptor gamma (PPARg) is a type two nuclear receptor whose protein pathway influences vascular development and regulation. Under hypoxic conditions, the functioning of the PPARg pathway is affected. The following research was conducted in attempt to bridge the knowledge gap between the PPARg protein pathway and its influences on vascular remodeling in preeclampsia. The direct correlation between PPARg activity and

vascular remodeling is not fully understood, and thus, this project was aimed to present more data on the subject which will allow for more effective treatment development. This project consists of two parts: the measurement of the PPARg pathway protein expression in placental tissue from normotensive vs. preeclamptic pregnancies using the wes (Bio-techne) system and, in the same samples, the characterization of the number and size of blood vessels terminating in the intervillous spaces, as well as determination of the pO2 levels in those vessels. The main ongoing question of the study is: does the expression of placental PPARg protein differ between pregnancies that are preeclamptic and normotensive?
https://symposium.foragerone.com/2021-racas/presentations/26862

Political Bias Assessment
Siena Negrón, *Social Sciences*
Mentor: Lori Twehues

Abstract:
The "Political Bias Assessment" study aims to answer the question, "Does an individual's inherent political bias toward the source of their news and self-identified party affect their perception of the information provided?" Subjects first took a pre-survey reporting their political party affiliation, opinions about the accuracy of Covid-19 testing, efficiency of Covid-19 restrictions, and their preferred trusted news source. They then watched two news clips about the accuracy of Covid-19 testing. One video clip was from Fox News, however both the logo and news banner was replaced by a CNN logo and news banner. The other video clip was from CNN, however, both the logo and news banner was replaced by a Fox News logo and news banner. Subjects then took a post survey and reported which news source they trusted more and their reactions to the different news sources. The data revealed a statistically significant association between self-identified party and the news logo associated with that party. The chi-square statistic is 8.9091. The p-value is .002838. The result is significant at $p < .05$. Apart from one individual out of thirty-four participants, no one questioned the validity of the content provided from the news clips. This study could be used as a future application to help people be aware of their biases, think for themselves, and avoid outside factors influencing their decisions and actions.
https://symposium.foragerone.com/2021-racas/presentations/26995

Predicting the Effects of Polyfluorinated Alkyl Substances on Fathead Minnows (*Pimephales promelas)*
Nour Awad, *Natural & Physical Sciences*
Mentor: Dr. Alan Vajda

Abstract:
Polyfluorinated alkyl substances (PFAS) are a large group of >3000 manufactured compounds with endocrine-disrupting properties. PFAS are used in both consumer and industrial products. PFAS can be found in most bodies of water around the world, with more than 600 known PFAS-contaminated sites across this country. In 2018 onsite-fish exposure experiments were conducted at Joint Base Cape Cod, MA (JBCC), to determine complex-mixture uptake and organismal effects in Fathead Minnows exposed to PFAS-contaminated groundwater. The occurrence and concentration of 38 PFAS were evaluated in groundwater and fish tissue samples. To assess the ecotoxicological risk of PFAS at JBCC, we compared these measured concentrations to literature values on the effects of PFAS in various fish species. A database consisting of over 60 journal articles on PFAS effects thresholds and benchmark toxicity values from different species of fish was used to evaluate the JBCC data. Of the 38 PFAS measured at JBCC, suitable fish ecotoxicity data were available for only 9 PFAS. Out of these nine PFAS, concentrations for five, PFOA, PFNA, PFOS, PFPeA, and FOSA, were found to exceed database-derived thresholds for adverse effects in fish. The concentrations at JBCC were up to 8000 times

greater than the concentrations in the database. These results suggest that concentrations of PFAS measured at JBCC are likely to adversely impact growth, reproduction, and survivorship in exposed fishes.
https://symposium.foragerone.com/2021-racas/presentations/27327

Prevalence of Veteran Homelessness: Examining Homelessness Among Veterans and Non-veterans
Ayush Uprety, *Data-to-Policy Project*
Mentor:

Abstract:
Homelessness among veterans has been of public concern for decades and billions of dollars have been invested towards this effort. Although veterans are generally older, better educated, more likely to be married, have better heath coverage and educational benefits, it is odd that veteran homelessness is
still a major societal issue.

First, understanding the prevalence of homelessness among veterans is prerequisite to preventing and ending homelessness among this population.
https://symposium.foragerone.com/2021-racas/presentations/27559

Preventing Pandemics
Alex Schaef, *Data-to-Policy Project*
Mentor:

Abstract:
Covid-19 has affected the entire world for over a year now. With vaccines being distributed, the pandemic is almost behind us. But what happens when a new virus is discovered? We can't shut down the world for a year or more every time a new disease starts to spread.

Using Covid-19 data from countries around the world, I have analyzed some of the variables that caused Covid-19 to be more prevalent in some countries than in others. Additionally, I have examined how different government responses have effected the spread of the virus in various countries around the world so that next time something like this happens, we will know what to do.
https://symposium.foragerone.com/2021-racas/presentations/27276

Project Revive Band (A METHOD TO REROUTE BLOOD DURING CPR FROM THE FEMORAL ARTERY TO THE BRAIN IN PEDIATRIC PATIENTS TO INCREASE BRAIN PERFUSION)
Jimmy Tangchittsumran, Leslie Fredrickson, Karl Larson, Danielle Piper, Devon Horton, *Biomedical Sciences, Technology, Engineering, & Mathematics*
Mentor: Mary Bevilacqua (MS), Craig Lanning (MS), Dr. Daniel Ehrmann (MD), & Dr. Taufiek Rajab (MD)

Abstract:
A METHOD TO REROUTE BLOOD DURING CPR FROM THE FEMORAL ARTERY TO THE BRAIN IN PEDIATRIC PATIENTS TO INCREASE BRAIN PERFUSION

Leslie Fredrickson, Bioengineering, College of Engineering, Design and Computing

Devon Horton, Bioengineering, College of Engineering, Design and Computing

Karl Larson, Bioengineering, College of Engineering, Design and Computing

Danielle Piper, Bioengineering, College of Engineering, Design and Computing

Jimmy Tangchittsumran (AS), Bioengineering, College of Engineering, Design and Computing

Faculty Mentors

Craig Lanning (MS), Bioengineering, College of Engineering, Design and Computing

Mary Bevilacqua (MS), Bioengineering, College of Engineering, Design and Computing

Dr. Daniel Ehrmann (MD), Children's Hospital Colorado

Dr. Taufiek Rajab (MD), Children's Hospital Colorado

Activity type: Undergraduate Human-Centered Need-Based Design

During CPR, pediatric patients in the ICU have excess blood flow to the lower extremities that could be used for the brain, increasing risk of brain damage. A cost-efficient, portable and size-adjustable device was developed to temporarily restrict blood flow to the legs, in order to force higher volumes to the brain. This device is made of a metal 3D printed buckle and polypropylene straps. The straps are long enough to allow for the device to be adjustable in size and fit a variety of patient bodies. The straps loop around both legs and thread through a specially designed buckle before being pulled tight and secured with Velcro. The straps are further tightened with a windlass device, which is secured by the buckle. Testing was completed on leg models made with two-inch multipurpose foam, which is comparable to the density of a leg. The device can be applied to the legs within 15 seconds and stay cinched for 30 minutes. Once applied, it decreases the diameter of each leg by 15% with an average of 1.67 twists of the windlass. When no longer needed, it can be removed with less than 6 lbs of force. Overall, this device has the possibility to lower rates of brain trauma due to lack of blood perfusion by adjusting blood volume locality from the lower extremities to the brain.
https://symposium.foragerone.com/2021-racas/presentations/27434

Protein Isoforms in Aged and Diseased Hearts

Julianna M Wright, *Natural & Physical Sciences*
Mentor: Maggie PY Lam

Abstract:
My name is Julianna and I am a junior majoring in Biology in the College of Liberal Arts and Sciences at the University of Colorado Denver. I am also a member of the University Honors and Leadership Program, and I am minoring in chemistry, leadership studies, and computer science. My project, under the funding of the UROP grant, is titled “Protein Isoforms in Aged and Diseased Hearts”. I worked under my mentor Dr. Maggie Lam, who is an Assistant Professor of Cardiology at the Anschutz Medical Campus, and alongside Dr. Erin Han, a postdoctoral fellow in the Lam Lab.
The goal of this project was to identify alternative forms of proteins between aged and diseased mice. Alternative splicing is a mechanism that causes the expression of more than one isoform of the same parent gene, and alternative

splicing can lead to differential expression of proteins of the heart. Alternative splicing has been known to modulate heart function, but the effect on proteins as a result of alternative splicing is understudied.
In the Lam Lab, I have previously investigated aging-specific alternative protein isoforms that are present only in aged hearts. Now, we are comparing this data to our diseased model, to determine similarities in the protein isoforms between aged and diseased hearts. We hypothesized that there would be proteins that are changed during both aging and disease. To investigate this hypothesis, our in-house proteomics pipeline was utilized, as shown in Figure 1. Isoproterenol was used to induce cardiac hypertrophy in young mice. Hypertrophy was evaluated with echocardiography, as shown in Table 2, as the left ventricle arterial wall (LVAW) thickness was increased, along with left ventricle mass to tibia length, all of which are common indicators of phenotypic cardiac hypertrophy. I extracted proteins from left ventricle tissues of mixed sex young and old, healthy and diseased mice, as shown in Table 1. I then digested these proteins with the enzyme trypsin under the filter-aided sample preparation (FASP) protocol, and I tagged these digested proteins with tandem mass tags, to allow for simultaneous quantification of multiple samples under 2D LC-MS/MS analysis on a Q-Exactive HF mass spectrometer coupled with Nano-UHPLC. The MS spectra were searched against a custom mouse protein isoform database and processed with an in-house Python script to quantify changes between proteins expressed in young and old hearts.
This study revealed at least 28 differentially expressed protein isoforms found between aged and diseased mouse hearts. Table 3 shows the top 10 changed protein isoforms found in both aged and diseased hearts. On average, ~10,000 proteins (canonical and non-canonical) were identified in each sample group. Protein extraction generated 3-4 µg/µL of protein per sample, and peptide concentration was ~0.20 µg/µL on average. The digestion efficiency of protein to peptide yield was ~70%. My next project will examine the phenotypic response of H9c2 cells to isoproterenol, and these cells will be used in our proteomics pipeline to evaluate the protein isoforms. These protein isoforms may be available to investigate their roles in heart function, which may lead to possible therapeutic targets for heart failure.
This project allowed me to learn many effective laboratory analysis techniques, and how to carry the experiment from beginning to end has helped me immensely on the path to becoming a clinical researcher. For this, I would like to thank the UROP committee for its support. I would like to thank my mentor, Dr. Maggie Lam, for giving me this opportunity and supporting me. I would also like to thank Dr. Erin Han, whose project I have been working on and been collaborating with for over two years. Thank you for your attention.
https://symposium.foragerone.com/2021-racas/presentations/27062

PROTEIN TYROSINE PHOSPHATASE (PTP) in Fertilization in *Xenopus Laevis* Eggs

Ahmed Twaige, *Natural & Physical Sciences*
Mentor: Dr. Bradly Stith

Abstract:
Fertilization in *Xenopus laevis* involves the activation and deactivation of Src tyrosine kinase in a cyclic manner. Regulation of Src tyrosine kinase is crucial because it is involved in many types of cancers; however its regulation and control are not yet fully understood. This research examines the role of protein tyrosine phosphatase in the regulation and control of Src tyrosine kinase. A fluorescent enzymatic activity assay kit was used to measure phosphatase activity, where increased fluorescence is directly correlated to protein tyrosine phosphatase activity. Preliminary results show a dramatic increase of fluorescence in the first minute of fertilization, suggesting early PTP activity before Src activation. PTP activity also appears to be cyclic. This supports the idea that PTP regulates Src activity and could potentially induce cycling of Src. In future experiments, PTP inhibitors will be used to determine if PTP regulates Src activity.
https://symposium.foragerone.com/2021-racas/presentations/25256

Public Transit on the I-70 Corridor

Mikhail Kaminer, *Social Sciences*
Mentor: Kirsten Christensen

Abstract:
Public transportation in the 21st century differs greatly on its uses and applications, and the environments into which it is introduced. A main question that transit planners face is the feasibility and efficiency that a proposed service will bring. The Denver Metropolitan Area has a series of services that allow passengers to commute from place to place, and one of the successful routes is the Flatiron Flyer (FF) by the Regional Transportation District (RTD). The research aims to understand what makes the FF so efficient, and how this efficiency can be applied to another route in the region— the I-70 Corridor between Idaho Springs and Denver. The researcher defines transit efficiency as a service that successfully and sustainably expands access to essential mobility without hindering the goals of all stakeholders. This definition guides the discussion of literary and demographic analysis made in Phase 1; followed by the field research based on time and lane analysis in Phase 2; and the final recommendations and conclusions in Phase 3. The findings advocate for a public transit option that must be flexible and adaptable to be efficiently implemented.
https://symposium.foragerone.com/2021-racas/presentations/27422

Putting the Sons and Daughters of Erin on the Map: The Colorado and Denver Irish, 1880
Kira Boatright, *Arts & Humanities*
Mentor: Dr. James Walsh

Abstract:
This presentation will provide demographic information collected from the 1880 U.S. Federal Census about first and second-generation Irish individuals in Colorado. The presentation will include a Colorado state map that I created based on this data and will visually represent the largest Irish populations that existed in Colorado in 1880. A historical map of Denver will also be included that locates where the Irish lived throughout the city of Denver in 1880 and identifies the city blocks that had the densest Irish populations. The presentation will also explore labor and the most common occupations among Irish men and women. This data demonstrates the way in which the Irish dominated occupations in skilled and unskilled labor and that the Colorado Irish were largely working-class. Additionally, I will discuss class by providing evidence of the prevalence of poverty among the Irish in Colorado in 1880, such as the existence of first and second-generation Irish living in tent encampments and a high density of Irish individuals living in boarding houses and hotels in Denver. This data will suggest that the American West did not automatically provide Irish immigrants with easily attainable opportunity and upward mobility. This presentation will be particularly meaningful to students and faculty of UCD because it will illustrate that the Auraria campus was in the center of Irish history and was at one point one of the most Irish neighborhoods in the city of Denver.
https://symposium.foragerone.com/2021-racas/presentations/26930

Recruit to Food in Pavement Ant Foraging
Emily Warsavage, *Natural & Physical Sciences*
Mentor: Michael Greene,Ph.D.

Abstract:
Ants, like other social insects, display complex collective behavior in the absence of designated decision-making leaders. Instead, individual ants follow certain behavioral rules, and their actions then guide the behavior of the colony as a whole. Agent-based modeling approaches the study of systems from the level of individual agents, who carry out a set of rules, so it is well-suited for exploring the process of how collective decision making arises from individual interactions

with other organisms and the environment. A primary example of complex ant behavior is food foraging, in which individual forager ants search for food in their environment, then signal the discovery of the food to other nestmates by returning to the nest and laying down a pheromone trail, which directs the efforts of the rest of the foragers toward that food source. During this process, the behavior of both the initial scouting ant and its nestmates is shaped by food quality. Initially, in some species, small groups of foragers that are recruited from the nest follow the scouts to the food in orderly lines, in a stage termed group-recruitment. Eventually, as increasing numbers of foragers are recruited, the groups spill into a teeming mass of ants traversing the pheromone trail between the food and the nest, in mass-recruitment. I used the Netlogo modeling program to explore the process of recruitment to food in *Tetramorium immigrans* (pavement ants), the most common ant in the Denver metro area. *T. immigrans* thrive in an urban ecological niche, in part due to their ability to outcompete other species for food. The model examines how foraging ants interact with each other and their environment to make the individual decisions that trigger a collective response by the colony to a food source, and the likely moderation of the process by food quality.
https://symposium.foragerone.com/2021-racas/presentations/27260

Return To School Success In Times of COVID
Alyssa Newman, *Data-to-Policy Project*
Mentor:

Abstract:
A big issue currently facing not just Colorado, but the whole world is how to send children back to face-to-face learning after a year or remote learning. Schools are looking at how to make improvements to the school over this summer to make next years experience safe and as successful as possible. In this project I am developing an optimization model that will aid schools in making difficult decisions on what policies to implement and changes to make in their school. This model will use integer programing techniques to make suggestions on policies and changes. This model will take into account many things, including the budget restrictions the school has, and the short term and long-term benefits to students learning and experience. The school administrators using the this tool will be able to specify which policies they are considering and also put in information like their budget to get suggestions tailored to them.
https://symposium.foragerone.com/2021-racas/presentations/27519

Sex Differences in a Rat Model of Growth Plate Injury
Nicholas Rotello-Kuri, *Biomedical Sciences*
Mentor: Karin Payne

Abstract:
Growth plate cartilage at the end of long bones and responsible for bone elongation can repair with bony tissue when injured. This is known as a bony bar that can cause growth disturbances. Our group's focus is to develop regenerative medicine approaches to prevent bony bar formation and regenerate growth plate cartilage. To test these treatments, we established a rat model of proximal tibial growth plate injury that reproducibly develops a bony bar. The goal of this study is to determine whether there are differences in the size of the bony bar and limb lengthening between male and female rats after growth plate injury. Drill-hole injuries were created in the proximal tibial growth plates of male and female rats. Bone lengths were measured from radiographs taken weekly the first month, and monthly thereafter. Bony bar formation within the injured growth plate was quantified using microCT. Male rats had longer tibiae than female rats for 3 months post-injury. Tibial growth rate diminished around day 42 post-injury for males and females. At 14 days post-injury, female injured rats had shorter tibias than intact rats. At 28 days post-injury, both male and female injured rats had a shorter tibia than their sex-matched intact controls. A bony bar was evident in male and female rats at 14

days and it was a similar size for both sexes at 14 and 28 days post-injury. While the volume of the bony bar within the injury site is similar between males and females, the females had a significant decrease in limb lengthening earlier than the males. Ongoing studies are measuring growth plate volume in male and female rats at various time points after injury. Understanding sex differences in the response to injury will allow us to better design future studies to include sex as a biological variable.
https://symposium.foragerone.com/2021-racas/presentations/27368

Sex Differences in the Neural Circuits Underlying Voluntary Exercise Behavior
Nashra Jamil , *Biomedical Sciences, Natural & Physical Sciences*
Mentor: Benjamin Greenwood Ph.D.

Abstract:
Females are more likely than males to develop stress-related psychiatric disorders, but the majority of stress resilience studies focus on males. We have observed that female rats benefit from the stress resilience effects of exercise more readily than male rats. Female rats also develop habitual exercise behavior more easily than males. This is important, because clinical studies indicate that maintaining habitual exercise is key to unlocking the stress-protective effects of exercise. The goal of this study was to determine if there are sex differences in the neural circuits underlying the development of habitual exercise. Identifying these differences could reveal why females are more responsive to the stress-protective effects of exercise. Fluorescent in situ hybridization for the neural activation marker cfos revealed that fewer days of exercise are required to activate a brain region implicated in habit (dorsal lateral striatum; DLS) in female rats, compared to males. Moreover, temporary inactivation of the DLS with a GABAA/GABAB agonist prior to a bout of exercise revealed that voluntary exercise behavior becomes dependent on the DLS in females (4 days) much earlier than it does in males (4 weeks). In contrast, males rely on the dorsal medial striatum (DMS, a region implicated in goal-directed behavior) early in the acquisition of exercise behavior (4 d). We have identified sex differences in the neural circuits controlling the development of habitual exercise. Future research will investigate whether the DLS contributes to the rapid stress resilience produced by exercise in females.
https://symposium.foragerone.com/2021-racas/presentations/27488

So You Want To Be A Producer?
Cassie LeFevre, *Arts & Humanities*
Mentor: Jessica McGaugh

Abstract:
Although film and television has never been more popular, not many people in the public domain know what a film producer does. Ask the average person about the role, and one's bound to get a superficial answer--because the film producer's work isn't as superficially recognizable on screen as an actor's or director's. Their work plays out, for all intents and purposes, behind-the-scenes.

As part of my EUReCA! Producer's Research Assistant Internship, I learned and experienced firsthand exactly what a film producer does. Through my work on two feature-length projects and one web series, I was exposed to the wide variety of challenges and responsibilities that face those in this inconspicuous role.

"So You Want To Be A Producer?" is a light-hearted, informative presentation on film producing. In the style of a retro, black-and-white educational video, it aims to enlighten the public about the undervalued work done by independent film producers across the world. From finding financing, hiring cast & crew, securing locations, and securing distribution

rights, "So You Want To Be A Producer?" exemplifies everything that I've learned as part of my year-long experience as a producer's research assistant.

This fun vignette is accompanied by the trailer to one of the major projects I worked on as a producer's assistant, a feature-length documentary entitled, *Three Worlds, One Stage*.
https://symposium.foragerone.com/2021-racas/presentations/25779

State Metrics Which Influence Human Trafficking
Wilfred Batchelder, *Data-to-Policy Project*
Mentor:

Abstract:
In 2019 alone the Polaris Project, an anti-human trafficking organization, helped over 22,000 survivors of human trafficking according to their website. This project compares the rates of human trafficking by state according to the Polaris Project's Human Trafficking Hotline. This metric is analyzed on various metrics state-by-state to try to find a pattern of underlying causes that encourage the human trafficking.
https://symposium.foragerone.com/2021-racas/presentations/27448

Subsidies and Grants based on Corporate Demand
Arvind Srinivasan, *Data-to-Policy Project*
Mentor:

Abstract:
Corporate demands determine the starting salaries for students in the workplace, and the goal of the education system is to create a workforce tailored to the workplace demands. This project's goal is to determine a subsidy/grant allocation that best suits the workplace environment by observing the starting salaries offered to graduating students entering the workforce, using regression analysis to correlate salaries to students' statistics to target the areas where the workplace has high demand.
https://symposium.foragerone.com/2021-racas/presentations/27530

Synthesis of 8-Oxo-2’-Ome-Guanosine for future aptamer modification
Shawn Schowe , *Natural & Physical Sciences*
Mentor: Dr. Marino Resendiz

Abstract:
Guanosine methylated at the 2’-O position of the ribose sugar has been shown to add stability when incorporated into an RNA biopolymer. The methylation helps the biopolymer form intramolecular interactions via de-solvation. In an effort to enhance the stability of future oxidation-modified oligomers, a novel multistep synthesis for 8-oxo-guanosine methylated at the 2’ position has been developed and is currently under investigation. Difficulty with guanosine in synthesis has to do with guanosine possessing multiple reactive centers. The only way to avoid this synthetic hurdle is through the protection of these groups in a selective manner. Recently, the methylated adduct, protected at all reactive centers, has been synthesized and isolated. All structural confirmation thus far has been given via analysis of proton nuclear magnetic resonance spectroscopy. In the future, the hope is to remove the protecting groups, oxidize position 8,

install a di-methoxy trital at the 5’ position, and a phosphonamidite at the 3’ position. Once accomplished, the aforementioned 8-oxo-guanosine adduct will be incorporated into an aptamer via solid phase synthesis to measure how oxidation changes the aptamers behavior.

https://symposium.foragerone.com/2021-racas/presentations/25333

Süleyman Demirel
Şükrü Karaoğlu, *Arts & Humanities, Social Sciences*
Mentor: Dale Stahl

Abstract:
Over the past two years, I have been developing, summarizing, and translating the works, which are about Turkish politics & water development projects, of Süleyman Demirel. I was involved in a broad literature review in both English and Turkish, and helped with study design, writing, editing, and reviewing. Demirel was one of the former presidents of Turkey from 1993 to 2000. He used to be a prime minister and studied previously in United States of the America. I have familial connections. My grandfather used to work under the supervision of Demirel as a water engineer. Although I never met Demirel in person, it is very fascinating to know that my grandfather was an employee and an acquaintance of Demirel. I learned about this fact after I started doing research on Demirel. Being connected to a famous, influential person, especially a president of a country, through family is a privilege and a prestige that not a lot of people have. It is important that I share this privilege with others and explain how my connection to him helped me understand his policies, personality, and life better. I was able to deepen my research by personalizing it even further. The translation I have done became more meaningful to me. I am going to do a presentation on how I am connected to him and relate my research to the experiences of my family with him. As a Turkish citizen and an aspiring social justice activist, I will use my connections to Süleyman Demirel to continue his legacy and restore his ideals based on Mustafa Kemal Atatürk’s vision in creating a free, democratic, liberal Turkey that protects the rights and freedoms of all human beings. Walking in his footsteps to make Turkey a better place is one of my life goals.

https://symposium.foragerone.com/2021-racas/presentations/27478

Tackling the High School Dropout Rate in Colorado
Cameron Steenblock, *Data-to-Policy Project*
Mentor:

Abstract:
Each year, Colorado residents pay around 7 billion dollars in taxes that fund public secondary middle schools and high schools across the state. Despite the state dropout rate of 1.8% , there are some schools in Colorado that have high dropout rates, with some even well above the country average of 5.3%. The Colorado Department of Education has collected data on the dropout rates of schools in each county, including the number of students who dropped out by race, sex, and other factors, such as if the student has a disability or if the student has limited English. The National Center for Education Statistics has a dataset as well, which details the expenditure for school per pupil for each county. Our goal is to use these two datasets to create a linear model that will show the factors that have the strongest relationship with the total dropout rate for each school. Our findings will hopefully help us inform schools which groups of students need more attention, which in turn will lower the dropout rate.
https://symposium.foragerone.com/2021-racas/presentations/27494

The Association Between Socioeconomic Status and Psychological Stress during the COVID-19 Pandemic
Hirah Sheikh, *Social Sciences*
Mentor: Dr. Jennifer Boylan

Abstract:
High levels of psychological stress increase the risk of developing a variety of diseases including depression, cardiovascular disease, and HIV/AIDS, among others (Cohen, Janicki-Deverts, and Miller, 2007). Socioeconomic status (SES) has a well-established association with most health outcomes and life expectancy (e.g., Chetty et al., 2016). Psychological stress is hypothesized to contribute to SES disparities in health (Cundiff et al., 2020), although it is unknown how these patterns may change during the COVID-19 pandemic, which has been a significant source of stress in the lives of most Americans (APA, 2020). The main research question was: Is SES predictive of psychological stress during the COVID-19 pandemic? Data on SES, in addition to physiological and psychological measures, were collected between May 2018 and April 2019. Participants (n = 93 healthy adults from the Denver metro area) were re-contacted one month into the COVID pandemic (April 2020) to report on their perceived stress, among other psychological measures. SES was measured with education (measured in 4 categories: high school, GED, or less; some college; bachelor's degree; greater than bachelor's degree) and reported difficulty paying for basic necessities (4-point scale ranging from very hard to not at all hard). Age and gender were included as covariates in all analyses. Results showed that participants who reported difficulty paying for basics during the lab session had higher perceived stress during the pandemic compared to participants who reported no difficulty paying for basics. No significant associations emerged between education and perceived stress. We will be examining experiences during the COVID pandemic such as worry, coping, and support systems as potential mediators of SES differences in stress.
https://symposium.foragerone.com/2021-racas/presentations/27598

The Brusselator: Entropy Production Surrounding a Hopf Bifurcation
Gessner Soto, *Natural & Physical Sciences, Technology, Engineering, & Mathematics*
Mentor:

Abstract:
This Brusselator mechanism represents a chemical reaction arrangement that can access a sustained-oscillation type of motion – a "limit cycle" type of motion – as its least resistant type of motion. A limit-cycle may be justifiably presumed to be the most basic type of non-stationary steady-state. The mathematical relationship associated with this Brusselator mechanism is specifically a collection of two coupled differential-equations that capture the evolution of the presence of two transient atoms or molecules that actualize as the product of mediative steps in the transformation of two chemical species from one arrangement of matter to another arrangement of matter. The Brusselator mechanism itself exists within the backdrop of an "open system": a context that may exchange both "energy" and matter with its immediate external environment. It may justifiably be stated that the change in "internal entropy" of a system is greater than zero when the "preferred distribution" of the contained arrangement has not actualized: a "separation" from the equilibrium state both initiates and sustains net internal motion to reconcile the imbalance relative to whatever it is that optimality references. Arrangements that exist within an open context are able to indefinitely be maintained away from their "preferred distribution". The "big question" underlying this project was – and is – { why are limit-cycles common constituents of arrangements at all-scales in the out-there? }.
https://symposium.foragerone.com/2021-racas/presentations/27476

The Colorado Cardiac Arrest Registry: A Quality Improvement Database
Hosbaldo Morales Murillo, *Natural & Physical Sciences*

Mentor: Shelby Shelton

Abstract:
Across the US, 475,000 people die from cardiac arrest each year. The University of Colorado Anschutz Medical Campus (AMC) treats about 200 cardiac arrest patients each year. The Colorado Cardiac Arrest Registry (CCAR) captures this data with the purpose of improving clinical quality. Multiple aspects are recorded such as demographics, past medical history, event logs relating to out of hospital or in hospital events, and continued care. CCAR was approved by COMIRB in 2016 (COMIRB #16-0137) as non-human subject research. All data is collected from the Epic electronic medical record retrospectively. Patient medical records are reviewed by trained research assistants and entered into the HIPAA-compliant REDCap database. The arrests reviewed here are from January 1, 2019 to December 31, 2019. From our database, we reviewed patient demographics and history relating to illicit drug use, alcohol use, smoking history, and the discharge outcome.

During 2019, there were a total of 166 cardiac arrests that came to UCH. From our database, the mean age for a cardiac arrest was age 62.5 years and a standard deviation of 17.04. Our results showed that 64.2% of cardiac arrest patients were male, compared to 35.8% which were female. From our data we can see that more males died from cardiac arrest compared to females and looking at race, White or Caucasian race made up 41.2% of our cohort, 32.1% of the patients were Black or African American. For ethnicity, 73.3% of the cohort identified as not Hispanic or Latino, 19.4% identified as Hispanic or Latino, and 7.3% were of an unknown ethnicity. Looking at illicit drug use, 10.0% of these patients had a history of using cocaine, 19.1% reported using marijuana, and 69.1% did not have prior drug use. For alcohol use, 26.5% had a history of alcohol abuse, 19.5% identified as social users, and 54.0% as never users.

With smoking history, 22.9% of these patients reported current cigarette use, 37.6% were prior smokers, and 39.4% were never smokers. There is some missingness amongst this data since some patients do not have this information available. These results are from the surrounding Aurora, Colorado area around UCH. The data shows that any smoking history is close to no history in percentage. Overall, the CCAR registry allows us to use this data to learn about cardiac arrest trends over time in order to improve clinical care and implement quality improvements to patient care at UCH.

https://symposium.foragerone.com/2021-racas/presentations/27471

The Development of Digital Government and the Existing Uncertainties

Gamlet Oganesean, *Social Sciences*
Mentor: Dr. Keith Guzik

Abstract:
Information and communication technologies (ICT) promise to transform government by bringing public goods and services closer to citizens. However, only 20% of digital state projects are successful (World Bank 2016). A variety of individual, organizational, political, cultural, environmental, and technical-level factors can introduce “uncertainty” (Marx and Guzik 2017) into the deployment of digital systems. Thus, *how governments deploy digital initiatives* is vital to consider.

This research explores this question by examining the case of *gosuslugi* (an abbreviation for государственные услуги, or state services), a portal of state services of the Russian Federation that allows Russian citizens to obtain government services remotely. Gosuslugi is a constantly developing project with the primary aim of digitalizing most government functions.

The COVID-19 pandemic presented novel opportunities to expand and test government digitization in Russia. In the wake of the pandemic, the Russian government emphasized the objective to socially distance citizens by introducing several services online, including informative resources, the online sales of medicines, and a united system of appointments to public and private hospitals. Government digitization during this time also included services in the spheres of economy, internal affairs, and social support.

My research attempts to understand the Russian government's use of the gosuslugi portal by collecting secondary data in the form of news articles related to the portal and qualitatively coding that data to identify major themes. Since gosuslugi is a constantly developing structure, the project specifically looks to understand the challenges or "uncertainty" that the government has encountered with the portal and the efforts it has made to address them. At the early stage of the analysis, it can already be remarked that gosuslugi has shown itself to be effective when it comes to preserving vital governmental functions in the middle of a pandemic.
https://symposium.foragerone.com/2021-racas/presentations/27465

The Effect of Eotaxin Protein on Healthy Lung Fibroblast Cells
Hunter Turbyne, *Biomedical Sciences*
Mentor:

Abstract:
Idiopathic pulmonary fibrosis (IPF) is a poorly understood respiratory disease that ultimately leads to respiratory failure. Prior research has found evidence of up-regulation of eotaxin expression in IPF lung fibroblasts when compared to healthy lungs, identifying this chemokine as a potential pro-fibrogenic marker. To test this, immunofluorescent staining, Western blot, and RNA extraction techniques were used to detect eotaxin presence within healthy lung fibroblast cells where control fibroblast cells would take on a fibrotic phenotype when exposed to eotaxin. The immunofluorescent imaging was inconclusive in detecting eotaxin within the treated cells, Western blot analysis found no eotaxin protein, and none of the genes of interest seemed to be expressed within the extracted RNA when compared to the TGF-β1 treated control. Further optimization would need to be carried out in future studies to see the effects of eotaxin on healthy lung tissue.
https://symposium.foragerone.com/2021-racas/presentations/27352

The Effects of the Tuition Assistance Program
Muzen Ahmed, *Data-to-Policy Project*
Mentor:

Abstract:
The Tuition Assistance Program (TPA) is a financial aid program that aims to help students who attend post-secondary educational institutions. The program has given financial support to a large number of students from higher education institutions in the past years. To examine possible future improvement directions for the program in terms of TPA recipient's dollars, we collected relevant data of 2019 academic year of the TPA. The data included several variables such as the recipient's age, financial status, income, and level of study, etc. We intend to answer the following questions: what are the main factors that influence the amount of the grant from the available data and, in particular, whether the amount of the grant is related to the economic status of the recipient and whether the latter has significant characteristics. Through numerical summaries and graphical analysis, we examine the age groups, study years, and other characteristics of recipients and conclude the main features and variations of the award money. Based on our findings,

we propose certain recommendations that we believe will help advance and improve the Tuition Assistance Program in the future.
https://symposium.foragerone.com/2021-racas/presentations/27499

The Impact of a Pandemic on Vulnerable Populations
Kaleigh Macdonald, *Social Sciences*
Mentor: Jennifer Reich

Abstract:
Individuals with chronic health conditions including those that lead to a weakened immune system have been identified as at increased risk of COVID-19 infection and are more likely to experience worse outcomes of infection. This study uses qualitative data from in-depth interviews with people who self-identify as immunocompromised or have a family member who is to examine how they manage their daily risk of infection. Findings show that individuals evaluate tasks such as receiving preventative care, going to the grocery store, or having family conversations in terms of how to manage risk. Participants also note that their vulnerabilities are often invisible to others. Findings suggest that risk management is complex and varies within this population.
https://symposium.foragerone.com/2021-racas/presentations/27344

The Impact of Wildfire Activity on Stream Temperature in Colorado
Jonathon Hirschi, *Data-to-Policy Project*
Mentor:

Abstract:
Stream temperature is an important environmental indicator as ecological problems arise when streams get too warm. Wildfires can impact stream temperatures in several ways, such as directly heating waters or destroying vegetation that provides cooling shade. Climate change is projected to cause increased wildfire activity, and it is important to understand how this will affect water quality. Using streamflow data from USGS, wildfire data from the National Interagency Fire Center, and climate data from PRISM, we develop a regression model for seasonal stream temperature for several locations in Colorado. We examine the relationship between wildfire activity and stream temperature in Colorado.
https://symposium.foragerone.com/2021-racas/presentations/27525

The Influence of Racial Bias on Clinician Judgments of Psychosis Symptoms in Clinical Examples
Alicia Privett, *Social Sciences*
Mentor: Michelle L. West, PhD

Abstract:
Background: Stigma based on race continues to exert influence on mental health care, with evidence that client race may impact clinical assessments/diagnosis, access to mental health resources, and quality of care. A commonly demonstrated finding has been that clinicians tend to over-label psychotic spectrum diagnoses for racial minority clients[1]. One comprehensive review of empirical articles found that African American/Black and Latino American/Hispanic people were disproportionately diagnosed with psychotic spectrum illnesses[2]. At the same time, there is evidence that stressors experienced by racial minorities may contribute to developing mental health concerns,

and researchers have described concerns about inequitable access to early intervention care for new mental health concerns in young people[3 4 5]. No previous research has investigated whether race/ethnicity impacts clinician judgements about clinical high risk for psychosis (CHR-p) symptoms. We aim to further this research by investigating how race/ethnicity in early psychosis clinical vignettes may impact clinical judgments.
Method: Participants include clinicians (varying specialties/levels of training) who endorse having early psychosis work experience (verified in study questionnaires). Participants complete a survey to screen for early psychosis experience and background in the mental health field. Each participant receives four vignettes that suggest a different level of psychosis spectrum symptoms (no psychotic symptoms, CHR-p symptoms, and acute psychotic symptoms). Each vignette is assigned a client race/ethnicity (Black, White, and Latinx) and the combination of race labels is randomly assigned to the participant's record id. Vignettes are followed by several questions that ask the clinician to evaluate judgments about diagnosis, early psychosis symptoms, likelihood of harm to self and others, and several other clinical questions. Finally, implicit bias is assessed through a semantic differential scale based on several visuals of people of different races. Analyses will investigate for impact of race on clinician judgments (e.g., two-way ANOVA and binary logistic regression).
Hypothesis: We hypothesize that clinician judgments will significantly differ based on client race, such that clinicians will judge racial minority clients (Black and Latinx) will be more at risk for psychosis than White clients.
Conclusions: Data collection is, currently, still in process. However, the results of this study will inform clinical understanding of how client race may impact clinician judgments of early psychosis cases. The study aims to challenge tendencies to exhibit bias towards racial minorities who present for early psychosis services, and to improve understanding of inequities in the mental health care system, which affects the distribution of resources and quality of mental health care.

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https://symposium.foragerone.com/2021-racas/presentations/27333

The King of The Arms: The History of Ballroom and the Exploration of Rashaad Newsome
Josephreuben Quinto, *Arts & Humanities*
Mentor: Dr. Yang Wang

Abstract:
This presentation explores the underground subculture of Ballroom and its representation in the contemporary art world. The Ballroom scene was founded in the early twentieth century during the Harlem Renaissance in New York. Its earliest founders and performers were African Americans, often queer, who coveted space of creativity and freedom of expression in a mainstream culture that excluded them. The Ballroom culture consists of houses, such as, the House of Labeija, Mugler, West, Margiela, Gorgeous Gucci, that compete in competitions called balls. These balls consist of

categories for people to compete in different categories that are inspired by the outside world, Runway, Face, Realness, and Vogue. Vouge is one of the most popular categories that is a dance form that is inspired by the poses of the models in magazines. [add a sentence or two here that describes what ballroom is and what balls are.] In recent years, this underground subculture has entered mainstream popular culture, most famously through Madonna's music video "Vogue." The history of Ballroom and its diverse community has been preserved through photography, video, and other forms of archival documents captured and collected by participants of Ballroom. The evolution of Ballroom also includes its intersections with contemporary art, which I will discuss through the artist Rashaad Newsome, a multidisciplinary artist who intertwines visual art, Ballroom culture, and Afro-futurism into his work. He creates his own ball called King of the Arms Ball, which bridges the two worlds together in creating an atmosphere of celebration for black and brown queer people. The King of the Arms Ball is so unique from other balls because it is not only inspired by Newsome's work but it is also inspired by the history of art and contemporary culture. My presentation will discuss how the Ballroom culture and contemporary art world intertwine with social history. Through this examination of Ballroom and Newsome's work, we gain an understanding of the subculture as a safe space for queer people of color, especially transgender people, that encourages individuality and expression.

https://symposium.foragerone.com/2021-racas/presentations/27475

The Life of Wilma Mankiller
Brandon Stanley, *Arts & Humanities*
Mentor: Donna Martinez

Abstract:
For my RACAS presentation, I will be detailing the life of Wilma Mankiller and why she is a significant figure in the history of the Cherokee Nation. I will begin my presentation with a short introduction to Mankiller, followed by the beginning of her life and events that would shape her adult life. I will then cover her move to the Cherokee Nation in Oklahoma, her work in the Cherokee government, and her eventual ascendancy to becoming the Principal Chief of the Cherokee Nation. After this, I will discuss her achievements during her time as chief, including the Bell Water Project and the construction of more healthcare centers in the Cherokee Nation. After this, I will discuss her post-political life, activism, and death. Finally, I will discuss the significance of Wilma Mankiller through her achievements and activism. This presentation will consist of a recorded PowerPoint.

https://symposium.foragerone.com/2021-racas/presentations/27453

The Net Effect of Wildfire and Lockdowns on Denver's Air Quality
Olja Kovacevic, *Natural & Physical Sciences*
Mentor: Ben Crawford

Abstract:
Poor air quality is a surmounting problem that is associated with adverse health effects including asthma, cardiovascular problems, respiratory infections, lung cancer, and mortality. Specifically PM2.5 (Particulate Matter 2.5) is noted to pose a risk to public health even at levels below national standards. Chronic exposure to polluted ambient air has been linked to health risks, however, specific shorter-term events can also influence local air quality and impact human health. During 2020, there were two notable events that influenced air quality and exposure to hazardous pollutants. In early spring, reduced vehicular travel associated with COVID-19 lockdowns resulted in notable improvements in air quality in cities around the world. In contrast, during August-October, record-setting severe wildfires inundated large areas of the

western US in smoke and substantially deteriorated air quality. The goal of this research is to investigate the impacts of these events on local air quality in Denver, Colorado. This research utilizes R to quantify the increase in pollutants during the wildfire period and the decrease in pollutants during the pandemic lockdown. We analyzed data from fourteen different air quality monitoring sites in Denver and attempted to summarize the net effect of air quality in Denver during 2020. The primary objective of this study was to examine whether or not there was an improvement in air quality considering the lockdown and wildfire events. We have found that PM2.5 levels are substantially higher during the wildfire events and the lockdowns resulted in substantially reduced no2 levels.
https://symposium.foragerone.com/2021-racas/presentations/27487

The Onset of Psychiatric Conditions Among Those with Acute Mild Traumatic Brain Injury (mTBI)
Diana Peraza, *Biomedical Sciences*
Mentor: Lisa Brenner

Abstract:
Abstract
Evidence suggests that elevations in biomarkers of inflammation within the first 24 hours post-trauma lead to worse outcomes for those with traumatic brain injury (TBI). Increased inflammatory response proceeding a brain injury may play a key role in the onset of psychiatric disorders. Research on the potential contributions of the microbiome, inflammation, and gut permeability to the onset/recurrence of post-TBI psychiatric disorders is limited. Therefore, in this prospective observational study, we aim to compare baseline and change values (i.e., from baseline to disease onset or study completion) of skin, oral, and gut microbiome composition and diversity among those that go on to develop a new or recurrent psychiatric condition versus those who do not in the year post-acute mTBI. Data includes collection of blood samples for screening biomarkers of inflammation and gut integrity, and non-invasive swabs of the skin, oral cavity, and gut for microbiome analysis. Additionally, clinical data is collected using psychometrically sound measures. Data collection is ongoing. The study results are intended to create a platform for evaluating the level and extent to which inflammation is activated by mTBI and how inflammation is affecting gut integrity and the human microbiome.
Keywords: mild TBI, inflammation, microbiome, mental health
https://symposium.foragerone.com/2021-racas/presentations/26714

The Power of Feminist Sexuality in Art: Carolee Schneemann and Caitlin Cherry
Annabelle Cohen, *Arts & Humanities*
Mentor: Maria Elena Buszek

Abstract:
Throughout the history of art, women's bodies have been used as an object for the delectation of presumed-male viewers, and were almost exclusively rendered by male artists until the 20th century. But, this representation of women's bodies for male viewing is not only an issue within the art historical canon, but also ripples out into the reality of a society that "learns" from images. During the 1960s and 70s, feminist artists such as Carolee Schneemann used their visual and performance art as a way to redirect the representation of women's bodies towards something beneficial for women. The artistic representation of women's nude bodies in works like Schneemann's has played a significant role in the endeavor of asserting the power of femininity and women's sexuality that has been controlled by men for centuries. Today, emerging artists such as Caitlin Cherry are still pushing for the expression of an authentic, uncontrolled femininity and sexuality, and fighting against the demoralizing and demeaning representations and perspectives of women that still arguably dominate visual culture today. While Schneemann produced her work as a political stance against sexual oppression in feminism's second wave, Cherry adds to this the significant component of racial inequality that was

frequently overlooked in Schneemann's generation. In this presentation, I will analyze how Carolee Schneemann and Caitlin Cherry examine the convoluted circumstances and concepts surrounding representations of sexuality, femininity, race, and women's bodies in art and society.
https://symposium.foragerone.com/2021-racas/presentations/27420

The Relationship between Income and Confidence in Government
Nick Gratto, *Data-to-Policy Project*
Mentor:

Abstract:
On January 6, 2021, the United States Capitol was stormed during a riot and violent attack against the U.S. Congress. Supporters of President Donald Trump
attempted to overturn his defeat in the 2020 presidential election by disrupting the joint session of Congress assembled to count electoral votes to formalize Joe
Biden's victory.

Corresponding with this political divisiveness, the economic inequality in the U.S. continues to grow potentially creating a negative feedback loop that could influence one's confidence in the U.S. government.

This study explores the relationship between income and confidence in the U.S. government.
https://symposium.foragerone.com/2021-racas/presentations/27620

The Relationship Between Sociodemographics and New COVID-19 Cases
Mikayla Medin, Souha Tifour, Bryan Heckman, *Data-to-Policy Project*
Mentor: Joshua French

Abstract:
Coronavirus is a global health crisis that has affected everyone. Variation in number of cases among continents has led us to explore if certain socioeconomic factors enable a country's predisposition to new COVID-19 cases. New cases per million is the response variable that is used to measure the influence of socioeconomic characteristics. The method that is used to explore the impact the number of new coronavirus cases per million is analyzing the data through R programming, using the following libraries: tidyverse, tibble, dplyr, and ggplot2. This is an exploratory data analysis on the dataset using our seven explanatory variables to figure out how those impact new coronavirus cases per million residents. New cases per million is used so a country's population is taken into account. Graphs are utilized to visualize data and make comparisons using linear models and regression. In conclusion, the data will show a universal policy is the best because covid cases aren't correlated to any socio demographic statistics.
https://symposium.foragerone.com/2021-racas/presentations/27484

The role of Structural Variants in Prader-Willi Syndrome (PWS)
Kayla Medina, *Biomedical Sciences*
Mentor: Dr. Tamim Shaikh

Abstract:

Prader-Willi Syndrome (PWS) is a rare genetic disorder that causes many complications in individuals who have this disease. Currently, there is evidence to support the role of genes located in a particular region of chromosome 15 (15q11-q13) in the etiology of PWS. However, the exact mechanisms for causality and symptom variability haven't been identified, and the specific genes involved and their role in the development of the various symptoms of PWS are being characterized but not yet known. One potential mechanism underlying PWS and the variability in symptoms observed is the presence of structural variants in the genomic region within the 15q11-q13 region of the genome. Prior to exploring this mechanism, we will recruit individuals with PWS to analyze the genomic DNA using technologies like optical mapping with Bionano Genomics which allows the analysis of long DNA molecules to detect structural variations. In the long term, we hope this approach will identify genomic differences specific to individual patients which may help predict risk and improve personalized treatment and management for some associated signs and symptoms in PWS.
https://symposium.foragerone.com/2021-racas/presentations/30582

The Synesthetic Mindscape

Jack Lewis, *Arts & Humanities, Technology, Engineering, & Mathematics*
Mentor: Cecilia Wu

Abstract:
The focus of “The Synesthetic Mindscape” is to imagine what it’s like to see sound. Synesthesia is a condition where one sense is perceived by another. Using the video game development tool Unity, it’s possible to build an interactive and immersive world where users have the opportunity to see sound in the form of photisms. Photisms are the colors and shapes synesthetes associate with a particular sound. Customized mathematical algorithms, audio DSP, and sound synthesis have been developed to translate real-time audio into these visuals. In addition, sound can be experienced spatially so that a user could easily locate a sound within the virtual environment similar to the way we locate sounds in real life. My work this semester has been in implementing an intuitive Application Program Interface and user interface in Unity. The interface is similar to other toolbars found in applications like Microsoft Paint and Adobe Photoshop. The UI allows users to add photisms to the environment, reposition them, and edit the sonic properties of the synthesized audio being used to visualize and render them. In the future, we believe that this software will be a valuable tool in teaching music students sound synthesis and ear training.
https://symposium.foragerone.com/2021-racas/presentations/26548

The timeline of Development, Gentrification, and Displacement of the Westwood Neighborhood.

Juan Franco, *Social Sciences*
Mentor: Marisa Westbrook

Abstract:
The Westwood neighborhood of Denver, Colorado, is one rich in culture and history. Largely ignored by the city of Denver after its annexation in 1946, recent attention to its potential for development has driven up housing costs, displaced low-income individuals of color, and attracted housing development and investment. Many of Westwood’s low-income Hispanic/Latinx residents are caught in the middle of a gentrification debate, as external economic interest and existing resident needs are weighed by the city and the community. In this study, I reviewed of media, archival research, Census demographic data, and information from non-profit groups in order to develop a timeline of the history of Westwood related to development and gentrification. An existing dataset of interviews with diverse community residents and stakeholders (e.g. monolingual Spanish speakers, undocumented residents, renters and homeowners, community leaders, etc.) was also reviewed to highlight the diverse feelings residents hold about the neighborhood’s current stage of development. As development is frequently documented

through the lens of economic growth, this timeline provides a balanced story including the perspective of residents who are at risk of displacement and shows the cyclical nature of housing booms and busts. Understanding the interactions between low-income residents and non-residents with economic interests is important to understand so that displacement is not swept under the rug when discussing economic development. Without attention to the cultural and historical context of neighborhoods at risk of gentrification and the needs of existing residents, neighborhoods like Westwood are oversimplified as “under resourced,” “poor” communities to be flipped into new and young communities.
https://symposium.foragerone.com/2021-racas/presentations/27481

Tracking Proton in Aqueous Solutions In Dynamics Simulations: Improved Algorithms
Sahitya Talachutla, Shamik Bhat, *Natural & Physical Sciences*
Mentor: Dr. Hai Lin

Abstract:
Proton transfer is ubiquitous in chemistry and biology but is challenging for molecular modeling. In contrast to an ordinary ion that diffuses in water, a hydrated proton “hops” over water molecules through reorganizing the hydrogen bonding network of nearby water molecules. This is called the Grotthuss mechanism,[1] which describes the diffusion of a structural feature instead of the given ion. Tracking the propagation of this structural feature is a prerequisite for many dynamics simulations. The Lin group previously developed a proton indicator, which represents the approximate location of the hydrated proton.[2,3] While the proton indicator follows the migrating proton smoothly in most situations, occasional large (up to 0.7 Å) displacements in the indicator’s position have been observed when donor switches, leading to instability in certain dynamics simulations. Here, we propose two new methods to determine the location of the proton indicator in aqueous solutions. Test calculations demonstrate that both algorithms significantly reduce these large displacements during donor switches. The improvements are promising and should enable better tracking of protons in dynamics simulation.

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https://symposium.foragerone.com/2021-racas/presentations/27396

Tracking the Bioactivity of MLL2 in Acute Myeloid Leukemia
Amy Hoang, *Biomedical Sciences*
Mentor: Patricia Ernst

Abstract:
Acute Myeloid Leukemia (AML) contributes to 1/3 of all leukemia diagnoses yet the general therapeutic strategy in patients with AML has not changed in more than 30 years. Therefore, this research will be focused on providing preliminary data that may be helpful for future AML therapeutics. Our group has shown that the histone methyltransferase gene, *MLL2* plays a major role in sustaining AML. To screen for compounds and factors that inhibit MLL2; two approaches are described here. First, I will create a reporter cell line with the integration of a fluorescent molecule into the MLL2-target gene. Second, I will develop a quantitative PCR assay for endogenous MLL2 target genes.

For the first approach, homology-directed repair (HDR) via the CRISPR/cas9 method will be used. Two HDR templates for fluorescent protein integration into the MAGOHB locus will be created. MLL2 directly activates the MAGOHB gene; therefore, by generating a reporter line, we will be able to track MLL2 activity via a red fluorescent protein called mCherry. The second approach is to develop a quantitative PCR assay for several NF-kB (Nuclear factor-kappa B, a transcription factor complex) target genes. The relationship between NFkB and MLL2 is that our group has previously found that multiple NFkB target genes were reduced upon deleting the *Mll2* gene in a murine leukemia line. Thus, we will have two assays to explore and develop a way to track MLL2 protein activity: one being using endogenous genes (NF-kB) and the other with our engineered MAGOHB reporter. These tools will enable us to test our own engineered MLL2 inhibitors and perform high throughput screens for compounds that inhibit this important leukemia survival pathway.
https://symposium.foragerone.com/2021-racas/presentations/27444

Trees Get Degrees: Decision Trees of Features for College Enrollment
Weston Grewe, *Data-to-Policy Project*
Mentor:

Abstract:
With so much information out there about what students need to do in order to get into college, it can be hard to know which things a particular applicant should focus on. This is true for schools as well, but they are restricted due to budgets and other outside factors such as a global pandemic. One way to narrow down the important college application features is through a decision tree. Our project creates an interpretable, optimal decision tree based on features that have an impact on college enrollment after high school.
This optimal decision produces a focused list of features which schools can work on adjusting or improving in order to make the biggest impact on their students' college enrollment. These features are determined via an integer program which maximizes the correct classification of schools which are both 'successful' and 'unsuccessful' in getting students to enroll in college directly after high school. For the purposes of this project, the benchmark for success is the average percentage of students that enroll in college after high school for a state in particular.
One notable aspect is that these features can pertain to the specific dataset they originate from instead of a one-size fits all solution. This allows the model to take into account school community specific features as well as events such as COVID-19 which can impact the required college application materials.
https://symposium.foragerone.com/2021-racas/presentations/27319

Understanding DNA secondary structure post C2'-O- Methylbenzothiophene modification
Cheyenne Phillips, *Natural & Physical Sciences*
Mentor: Marino Resendiz

Abstract:
The function and stability of RNA and DNA depend on their structure, and by chemically modifying DNA and/or RNA these properties may be altered. For example, altering the structure of RNA/DNA may inhibit or prohibit interactions (i.e., binding) with proteins. In this study, the 2' position of RNA and DNA nucleotides were modified to contain a 2-Methylbenzothiophene, an aromatic modification with potential to impact nucleobase pi-pi stacking in duplexes. The goal was to understand how this chemical modification affects the duplexes' structure and stability in order to potentially stabilize RNA/DNA and/or target different proteins. Adenosine and uridine phosphoramidites containing 2-Methylbenzothiophene were synthesized, and the modified bases were incorporated into RNA or DNA oligomers via solid phase synthesis. Then, the duplexes' structure and stability were determined via circular dichroism(CD). The CD

spectra for the unmodified and modified duplex were characterized by bands at different wavelengths, suggesting a structural difference between the unmodified duplex and the modified duplex. The thermal melts showed the unmodified duplex to be more stable, except in 2M NaCl where the modified duplex is more stable.

https://symposium.foragerone.com/2021-racas/presentations/26661

Understanding key drives of Obesity in US

Yonas Semereab, *Data-to-Policy Project*
Mentor:

Abstract:
Nearly two-thirds of adult Americans are overweight or obese. Despite the attention of the health profession, the media, the public, and mass educational campaigns about the benefits of healthier diets and increased physical activity, the prevalence of obesity in the United States has more than doubled over the past four decades.
This project aims to identify relationships between Body Mass Index and other factors, like diastolic BP, total Cholesterol, diabetes, sex, age etc. The data is collected from Framnigam heart study database, in Massachusetts.
https://symposium.foragerone.com/2021-racas/presentations/27496

Understanding the Associa0on Among Environment, Microbiome, and Golden Retriever Health

Kayla Medina, *Natural & Physical Sciences*
Mentor: Christopher S. Miller

Abstract:
Golden Retrievers across the United States suffer from increased adverse health outcomes due to obesity. However, there has been limited study of the link between environmental factors such as diet and microbiome, and how that might affect dogs who suffer from an adverse health outcome. Given the fact that there is a strong association between microbiome composition and body condition in humans and mouse models, we hypothesized that there is a relationship among diet, microbiome, and adverse health outcomes in dogs. To begin to explore this hypothesis, we utilized high throughput 16S rRNA gene sequencing methods. Using a Course Based Undergraduate Research Experience in General Biology labs, we have characterized the microbiome composition of 400 Golden Retriever fecal samples with replication and measuring the student's ability to replicate samples efficiently. Moreover, early results suggest that there is a core microbiome of five prevalent organisms (in the genera: *Faecalibacterium prausnitzii*, *Prevotella copri, Ruminococcus gnavus, Balutia producta, and Clostridium hiranonis)* that occur at least 75% of samples including replicates prior to filtering that are in the gut microbiome of the dogs in our study. Our work is one of the largest samplings to date to characterize the common microbes found in a single dog breed and lays the groundwork for understanding associations among variation in microbiome composition, environmental factors, and health. associations among variation in microbiome composition and environmental factors.
https://symposium.foragerone.com/2021-racas/presentations/27455

University of Colorado Denver Student Perception of Auraria Campus Police

Samantha Dungey, Leah Mauff, Mynam Truong, *Social Sciences*
Mentor: Dr. Vivian Shyu

Abstract:
Generally, university students are not fully aware of the activities of their campus police officers (Hodges, 2016). This leads to decreased feelings of safety and likelihood to contact (Jacobsen, 2014). The purpose of our study was to evaluate University of Colorado Denver (UCD) students' perception of the Auraria Campus Police Department (ACPD). We predicted that UCD students' awareness of ACPD would be relatively low, that few students would perceive them as legitimate, and that these factors would predict students' feelings of safety and likelihood to contact ACPD. We surveyed a convenient sample of 137 UCD students and our survey consisted of 49 questions that assessed (1) students' awareness of the resources offered by the ACPD along with factors of authority, (2) perceptions of the legitimacy of the ACPD, (3) feelings of safety on campus, and (4) likelihood of contacting the ACPD for assistance. Our results showed some very strong positive correlations, where *awareness was linked to perceptions of legitimacy* (R2 = .60, p = .001, N= 109) and *legitimacy predicted likelihood to contact* (R2 = .60, p = .001, N= 101). Positive correlations were also found between *awareness* of ACPD and *feelings of safety* (R2 = .53, p = .001, N= 104) and between *awareness* and *likelihood to contact* (R2 = .53, p = .001, N= 101). While not as strong, correlation was found between students' perceived *legitimacy* and *feelings of safety* (R2 = .48, p = .001, N= 104) and *feelings of safety* and *likelihood to contact* (R2 = .30, p = .001, N= 101). These findings suggest UCD students that have more awareness of ACPD resources/authority are more likely to perceive them as more legitimate, feel safer, and reach out when needed. Future research should explore the impacts of social justice movements on perceptions of municipal versus campus police by surveying a larger, more representative sample of the population.

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https://symposium.foragerone.com/2021-racas/presentations/27401

Using Design Innovation Method Cards as a Vehicle to Study and Address Interdisciplinary Challenges Regarding the Presentation of Design Information

Anthony Porcaro, Ishea Lee, Keith Contois, Arianne Collopy, Kristin Wood, *Social Sciences*
Mentor: Arianne Collopy

Abstract:
This study is an investigation into what supports and inhibits successful interdisciplinary collaboration using a set of Design Innovation (DI) Method Cards. A survey exploring the perceived difficulty in understanding the cards, applying the cards in a collaborative project, and explaining the cards to others was sent out to adults with various levels of familiarity with DI as well as different educational backgrounds. While there was a majority regarding ease of understanding and ease of application in a collaborative design project for each card, the proportions of ratings varied by discipline. The study also found a perceived higher difficulty explaining a method to those outside one's discipline as compared to those within it. Three major needs for the cards were identified through literature and survey feedback: understandability (regarding the language used), usability (regarding organization, structure, and readability), and clarity of purpose (an overall mindset, understanding of that mindset, and explanation of how the presented information relates to that mindset). Results from this first study have prompted the creation of design changes made to the set of Design Method Cards with regard to understandability, usability, and clarity of purpose. These design changes will be

evaluated as part of an ongoing study. Ultimately, results from this study will contribute to facilitating more effective interdisciplinary design in education and practice.
https://symposium.foragerone.com/2021-racas/presentations/27385

Using Eye Tracking to Investigate the Effects of Interruptions on Attention and Performance
Michael Martinez, *Social Sciences*
Mentor: Dr. Carly J. Leonard

Abstract:
Interruptions and distractions are a common occurrence of everyday life and at times can be a nuisance on one's ability to perform daily tasks. Using eye-tracking, this study will investigate the impact of distraction during different workload environments and the effect it has on attention and other cognitive processes. It is unclear if interruptions and workload environment negatively impact attention and influence the ability to perform a cognitive task. Kanaan & Moacdieh (2021), found evidence showing that the number of eye movements changed after an interruption and evidence suggest this may have led to low performance on the main cognitive task. To gain a better understanding of the impact of distractions on attention and performance, we will examine eye movements before and after a distraction in different workload environments. Participants will take part in a task scenario in which their primary task is to monitor a computer screen and detect changes in objects. Depending on the workload condition, participants will be required to notice a change in either a large or small number of objects. In a distraction condition, they will experience an irrelevant auditory disruption while doing the primary task. Based on trends in Kanaan & Moacdieh (2021), we hypothesize that a lower number of eye-movements after an interruption will not impair performance but improve it.
https://symposium.foragerone.com/2021-racas/presentations/27445

Using Eye Tracking to Investigate the Effects of Interruptions on Performance and Attention
Michael Martinez, *Social Sciences*
Mentor: Dr. Carly J. Leonard

Abstract:
Interruptions and distractions occur every day, and at times can be an inconvenience on one's ability to perform simple daily tasks. To investigate the influence distractions, have on attention and performance, this study will utilize eye tracking to conduct an examination of auditory distractions during two different workload conditions. Evidence from Kanaan & Moachdieh (2021) suggest that interruptions lead to slower and more limited search of visual information directly after the interruption in a high-workload condition, resulting in lower mean saccade amplitude and higher mean fixation duration. To acquire a better understanding of distractions on attention and performance this study will focus on irrelevant auditory distractions that occur during the task. Participants primary task will be to monitor a computer screen and detect subtle changes in shapes on the screen. Changes will be noted for the objects they are able to detect by pressing a button on a gamepad. There will be a high-workload condition (7-9 shapes) and a low-workload condition (3-5 shapes), as well as two distraction conditions comprised of trials with irrelevant auditory distractions and trials without auditory distraction. Eye movements will be examined across conditions. We hypothesize that the results will align with Kanaan & Moachdieh and that there will be a higher mean fixation duration and a lower mean saccade amplitude after an auditory interruption in the high-workload condition, although the auditory information is completely task irrelevant.

Kanaan, D., & Moacdieh, N. (2021). Eye Tracking to Evaluate the Effects of Interruptions and Workload in a Complex Task. *Human Factors: The Journal Of The Human Factors And Ergonomics Society*, 001872082199048. https://doi.org/10.1177/0018720821990487
https://symposium.foragerone.com/2021-racas/presentations/30570

Utilizing Small Molecule Binding to Assess Protein Structure
Alexander Plonski, *Natural & Physical Sciences*
Mentor: Scott Reed

Abstract:
Protein structure prediction has been a challenge in computational biology, and decades of work have been focused on finding solutions. Recent advancements made by AlphaFold2 an artificial intelligence developed by the company DeepMind has shown promise to solving this decade-long challenge. AlphaFold2 has shown accuracy in predicting the general structure of a protein, however limitations exist when predicting the molecular level details of a protein correctly. These molecular details are crucial to protein function and specifically important in drug-protein interactions, where the misidentification of one atom in a binding site could potentially affect the binding and in turn, the predicted efficacy of a drug. Our work aims to compare modeled protein structures to their experimentally determined counterparts on the molecular level utilizing small molecule binding techniques. We have created a set of over 1300 small molecules from human, E. coli, and yeast organisms that are molecularly docked on 31 AlphaFold2 and experimental protein structures. Significant improvements have been made to increase the overall efficiency of result collection and analysis, allowing for over 82,700 drug-protein interactions to be analyzed. The resulting interactions are analyzed by the comparison of the AlphaFold2 and experimental structures using metrics that have been developed to measure conformational and distance changes for the docked small molecules. We will explore how the molecular differences between the modeled and experimental structures impact small molecule binding based upon the differences between the conformation and binding location for the experimental and modeled structures.

https://symposium.foragerone.com/2021-racas/presentations/27463

Visitor Shuttle Reservation Behavior at Zion National Park
Claire Finn, *Data-to-Policy Project*
Mentor:

Abstract:
Due to the COVID-19 pandemic and increasing difficulty in protecting both park resources and a quality visitor experience, Zion National Park implemented a mandatory reservation system to use the shuttle bus in July 2020 to enter the most popular area of the park. This study explores patterns in 2020 shuttle ticket reservation behavior at Zion National Park to answer the following questions: What is the no-show (tickets are not used) and over-buy (fewer tickets used than were reserved) rate for primary (reserved two to four weeks in advance) and secondary reservations (reserved 24 hours in advance), and is there a significant difference between them? What other variables (time of day, month, date) significantly influence no-show rates? ANOVA and logistic regression show that visitors do not show up for their reservations 58% of the time with primary reservations and 37% of the time with secondary reservations, no-show rates increase after 9 a.m., and over-buy rates are a small but significant factor in determining how many tickets to sell. Zion National Park can use these results to implement changes to the shuttle reservation system such as overbooking shuttle tickets that will allow more visitors to enjoy the park while maintaining visitor capacity on the shuttle.
https://symposium.foragerone.com/2021-racas/presentations/27311

Walk Scores and Mental Health: Is there a relationship between the Walk Scores of Colorado cities and mental health?

Shauna D'Amato, *Data-to-Policy Project*
Mentor:

Abstract:
Walk score of a neighborhood though a relatively recent term, is not a recent concept. It is a score out of 100 and refers to the walkability of a specific area. It is
calculated by road metrics, how pedestrian friendly it is and the amount of amenities found within a 5-minute radius of the location (1). Traditionally, these
scores have been used as a way to boost real estate appeal. However, more recently, experts have begun to examine whether walkability of neighborhoods can offer anything additional, such as sustainability, environmentalism, financial and public health benefits.

The purpose of this study is to examine if the walk scores of Colorado cities correlate to an individual's mental health.
https://symposium.foragerone.com/2021-racas/presentations/27547

Washington D.C: The Movie

Jacob Johnson, *Arts & Humanities*
Mentor: Andrew Scahill

Abstract:
The Washington Monument. The Lincoln Memorial. The White House. These hallowed monuments to the history of the United States of America are just a few in a number that dot the skyline of our nation's capital: Washington D.C. This city takes on a certain iconography as not only are these monuments reflective of our national ideals, but the city itself is the seat of American political power and ideology. So why is a city so iconic barely mentioned in the film community? To date, hardly anyone has attempted to analyze the representation of Washington D.C on film. Many scholars have examined the representation of other iconic American cities such as New York City or Los Angeles in film, but D.C is surprisingly absent from the bulk of this research. This project strives to remedy this absence, and examine just exactly how our nation's capital is represented through the medium of film. This project is extensive, as films portray cities such as Washington D.C through a multitude of perspectives. This can range from Washington being viewed as a city of hope and opportunity in films such as *Mr. Smith Goes to Washington*, to it being viewed as a city of deceit and corruption in films such as All the President's Men. However, for the purposes of this project, we will examine the representation of the District of Columbia through the lens of the most popular genre set in Washington D.C: the political thriller. We will examine how films such as *The Bourne Identity* challenge an individual's relationship to a governmental authority, and how the ideals of American patriotism and virtue exemplified in characters such as Jack Ryan in *Clear and Present Danger,* but above all, we will examine how this genre reflects the narrative and the aforementioned iconography, of the city that gives it its meaning.
https://symposium.foragerone.com/2021-racas/presentations/27452

What actually happens in aWriting Center? NLP and computational analysis applied to Writing Center data to create comprehensive topic models

David J DeBonis, *Arts & Humanities, Social Sciences, Technology, Engineering, & Mathematics*
Mentor: Drew Bixby

Abstract:
A Writing Center (WC) collects tremendous amounts of data. Although the CU Denver WC consistently analyzes this data, this analysis is generally limited to discrete variables. However, there are also paragraphs of text-data collected for each session; this data is vital for pedagogy, but has not been applied to large-scale analyses. This study seeks to use Natural Language Processing (NLP) to better understand the WC's data.

WC data from August 17, 2015 through December 09, 2020 was exported, then cleaned and analyzed using Python; this produced a dataset of 25,115 appointments. The analysis focuses on the following features from client report form (CRF) data: after each WC session, a consultant chooses up to three foci (from a predetermined list) which summarize the session; the consultant then describes the activity of the session through open-response questions.

Step one in this study's NLP analysis was, for each appointment, to clean and concatenate CRF text-data into one text-set, then vectorize it by word-tokens. Step two was to apply TF-IDF scoring to statistically extract one feature word from each text-set. (The feature word is essentially the most salient word of the open-response, as determined by frequency/relative-proportion both within and across all text-sets.) For step three, these feature words were grouped by session focus and organized into topic models containing the top 20 feature words for each focus. Finally, models were organized into word clouds for visualization.

The value of analyzing the descriptive reflections of WC sessions is a systematic understanding of what happens during the learning experience of a WC consultation. In short, it provides both depth and breadth to the question, "What actually happens in a Writing Center?" This data in visual form may help students, faculty, and university administrators better conceptualize the value of WCs to student learning and success.
https://symposium.foragerone.com/2021-racas/presentations/27317

Whitewashed: The Unwritten History of Black Africans in Renaissance Europe

Florence Blackwell, *Arts & Humanities*
Mentor: Dr. Jeffrey Schrader

Abstract:
The Renaissance is mentioned in every history course that covers Europe, and has long been a popular area of study for university students. However, we tend to learn about the period from a romantic perspective that prioritizes Italy's cultural and artistic developments – an incomplete picture and leaves little room for critical thinking about its subject matter. Art historians focus their gaze on artworks that feature white European bodies, so it is easy to miss the Black people who were also present during this time of early modernity. Historians have disregarded Black peoples' presence in the Renaissance, despite their visibility in countless artworks produced during the epoch. The depictions of Black figures in early modern art provide clarity as to why European culture was capable of advancing: the slave trade and colonialization. This information is rarely taught in history curricula which distorts how we understand the past and erases the residual memory of slavery from the descendants of enslaved peoples. This presentation will illuminate the unwritten history of Black Africans in Renaissance Europe by employing two art historical methods: visual analyses of works of art featuring Black Africans and historiographical analysis of Renaissance studies since its formation in the 18th century and revitalization in the United States amid World War II. My findings reveal that major European port cities were responsible for importing African slaves, and yet many historians have trepidations about approaching this topic.

https://symposium.foragerone.com/2021-racas/presentations/27405

Wilma Mankiller and The Cherokee Nation: Contemporary Indigenous Women Leadership
Aurelia Guerue, *Social Sciences*
Mentor: Donna Langston-Martinez

Abstract:
Chief Wilma Mankiller of the Cherokee Nation incorporated Cherokee ideologies and values into her leadership and political actions. The examination of Chief Mankiller's political actions and programs provides insight to the model of leadership that contemporary Native women utilize which is heavily influenced by traditional ancestral knowledge. Chief Mankiller's use of Indigenous values in political and social programs were extremely successful among the Cherokee Nation. This leadership model can provide guidance to future Native women who wish to become political actors or leaders within their Nations or the U.S. This model also illuminates the ways in which Traditional Indigenous Knowledge must be incorporated in political and social programs for Native peoples. The use of Traditional Indigenous Knowledge and values in designing and implementing social programs for Native peoples is beneficial for these communities.
https://symposium.foragerone.com/2021-racas/presentations/27600

Womanhood: The SeriesEmpowering Women Through Media
Willa Cohn, *Arts & Humanities*
Mentor: Jessica McGaugh

Abstract:
Womanhood: The Series, is an episodic comedy series about breaking the taboo of showing women's issues on screen, with the goal of drawing attention to the absence of female perspectives in film and television. As well as filming three episodes as part of a "proof of concept reel," my project is researching and contacting producers and larger production studios that will be sympathetic to our purpose and interested in picking up the series to produce and distribute on a larger scale.
https://symposium.foragerone.com/2021-racas/presentations/30325

World Happiness by Country
Joseph Suematsu, *Data-to-Policy Project*
Mentor:

Abstract:
The pursuit of happiness has been mysterious for centuries. In society it has lent itself to create better economies and improve the health of its occupants. This study will attempt to find what factors may lead to a happier society using data from The World Happiness report. With comparing metrics, certain relationships may help suggest policies which can better foster happiness.
https://symposium.foragerone.com/2021-racas/presentations/27497

Increased lactate production and mass in the perirenal adipose tissue of fetal sheep with prolonged hypoxemia
Betelhem Ashebo, *Natural & Physical Sciences*

Mentor: Dr. Stephanie Wesolowski

Abstract:
Introduction: The major period of proliferation and differentiation (adipogenesis) of pre-adipocytes is during fetal development. Thus, gestation is a critical window where adipose mass can be programmed as supported by studies in humans and animal models showing "catch-up" growth and adipose tissue expansion after *in utero* nutrient and growth restriction. The objective of this study was to test the effects of hypoxemia, a feature of pregnancies with fetal growth restriction, on fetal adipose tissue development. Our hypothesis was that prolonged exposure to intrauterine hypoxemia would increase perirenal adipose tissue (PRAT) mass because of increased nutrient utilization and lipid synthesis.

Methods: We used pregnant sheep to produce hypoxemia (HOX) via maternal intratracheal nitrogen gas insufflation for 10 days, between 0.8 to 0.9 gestation, compared to ewes receiving intratracheal compressed air (CON). At the end of study, fetal blood and PRAT samples were collected from CON (n=7) and HOX (n=10) fetuses. Gene expression, protein expression, lipid content, and assays of mitochondrial function were measured. Data were analyzed by *t*-test.

Results: HOX fetuses had a 20% decrease in fetal arterial pO_2 and no change in fetal weight. PRAT mass, absolute and relative to fetal weight, was increased by 30% in HOX fetuses (*P*GLUT4) was unexpectedly decreased in HOX PRAT, while expression of lactate dehydrogenase (*LDHA*) and the lactate transporter (*MCT1*) were increased (*P*GLUT1, *PFK1*), lipogenic (*FASN*, *SREBP1C*), or adipogenic genes (*PPARG1*, *PPARG1*, *LEP*, *UCP1*). Triglyceride content (per g of PRAT) and mitochondrial DNA content, a measure of mitochondrial capacity, was similar between groups. Expression of *PDK1* and *PDK2*, pyruvate dehydrogenase kinase genes, tended to be increased (*P*P=0.07). In HOX compared to CON fetuses, plasma glucose concentrations were similar, yet lactate, pyruvate, and norepinephrine concentrations were increased, and insulin was decreased. In CON and HOX fetuses, PRAT mass was associated with plasma lactate concentrations (r^2=0.36, *P*LDHA expression (r^2=0.41, *P* **Conclusions:** Our results demonstrate increased PRAT mass, limited pyruvate oxidation, and increased lactate production in HOX fetuses, in the absence of increased triglycerides and lipogenic genes. We speculate that increased lactate production may provide an alternate fuel source for adipocytes or that lactate may antagonize lipolysis, as it does in human and rodent adipocytes. Additional studies are needed to test this and further characterize adipocyte size and type (multilocular versus unilocular lipid droplets). Together, this will provide new insight into the mechanisms for how hypoxemia primes adipose tissue expansion *in utero*.
https://symposium.foragerone.com/2021-racas/presentations/27262