

**RESEARCH & CREATIVE ACTIVITIES SYMPOSIUM**

FRIDAY, APRIL 29, 2022

**25<sup>TH</sup>**

**ANNUAL**



University of Colorado Denver | Anschutz Medical Campus

**25<sup>th</sup> ANNUAL RESEARCH AND CREATIVE ACTIVITIES SYMPOSIUM (RACAS)**

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

In our Virtual Project Showcase, you will find digital presentations showcasing the work of over 150 student presenters. We encourage you to take time to explore projects both within and outside your discipline - you never know where inspiration will strike! Use comment walls to start a conversation with student presenters. Presentations will remain posted after RaCAS so you can continue to discover and enjoy them!

Full schedule and details are available at <https://symposium.foragerone.com/2022-racas/presentations>

**RACAS 2022 SCHEDULE**

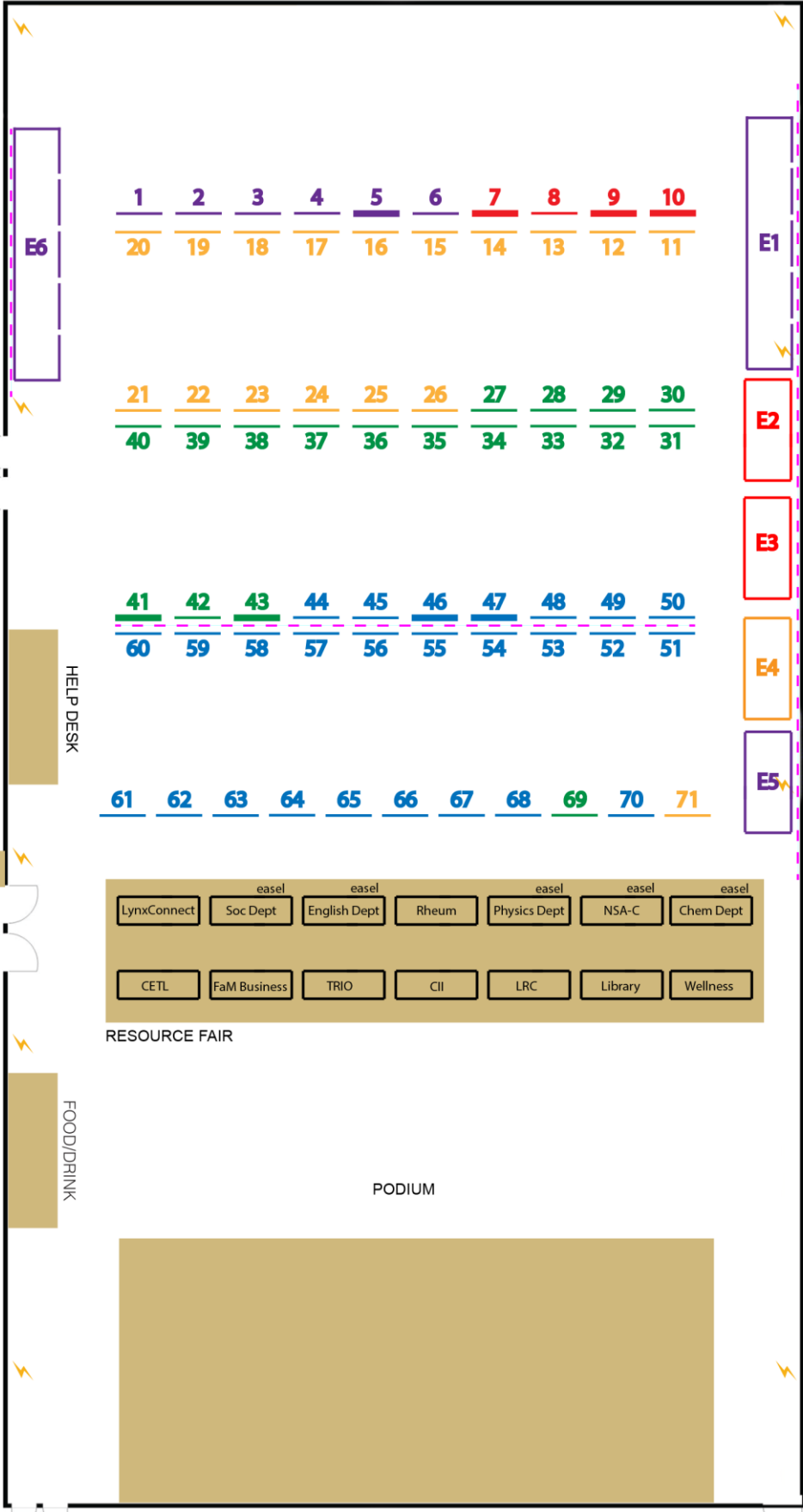
	Wellness Center	SCB 1500	SCB 1600	SCB 1401	LC 2205	LC 2230	LC 2222
8:00	Presenter Check-in, Exhibit Setup, Reviewer Orientation, Resource Tabling Setup						
9:00	Opening Remarks						
9:30	Poster Session 1 Resource Fair	STEM 1 Presenter Setup	SS&H 1a Presenter Setup	SS&H 1b Presenter Setup	Hyflex Moderator Setup	Session Setup	
		STEM Session 1	Social Science & Humanities Session 1a	Social Science & Humanities Session 1b	Hyflex Poster Session 1	Art History Special Session	Workshop Setup
11:00	Poster Session 2	STEM 2 Presenter Setup	SS&H 2 Presenter Setup	A&M Presenter Setup	Hyflex Moderator Setup		Dark Matter Workshop
		STEM Session 2	Social Science & Humanities Session 2	Arts & Media Session	Hyflex Poster Session 2		
12:30	Lunch						
	Closing Remarks						
1:30							

# WINDOWS

- Tech, Engineering, & Math
- Social Sciences & Humanities
- Biomedical Sciences
- Arts & Media
- Natural & Physical Sciences

- Easel
- Easel + Cocktail Table
- Extension Cord/Surge Protector



<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>
20	19	18	17	16	15	14	13	12	11

<u>21</u>	<u>22</u>	<u>23</u>	<u>24</u>	<u>25</u>	<u>26</u>	<u>27</u>	<u>28</u>	<u>29</u>	<u>30</u>
40	39	38	37	36	35	34	33	32	31

<u>41</u>	<u>42</u>	<u>43</u>	<u>44</u>	<u>45</u>	<u>46</u>	<u>47</u>	<u>48</u>	<u>49</u>	<u>50</u>
60	59	58	57	56	55	54	53	52	51

<u>61</u>	<u>62</u>	<u>63</u>	<u>64</u>	<u>65</u>	<u>66</u>	<u>67</u>	<u>68</u>	<u>69</u>	<u>70</u>	<u>71</u>
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easel		easel		easel		easel		easel		
LynxConnect	Soc Dept	English Dept	Rheum	Physics Dept	NSA-C	Chem Dept				
CETL	FaM Business	TRIO	CII	LRC	Library	Wellness				

RESOURCE FAIR

PODIUM

BLEACHERS

E6

E1

E2

E3

E4

E5

HELP DESK

CHECK-IN

FOOD/DRINK

# RACAS 2022 AWARD WINNERS

## POSTER SESSION CATEGORY AWARDS

### Arts & Media

- Outstanding Poster/Exhibit - **Jacob Williamson** - [Colorado Petroglyph 2022: Mammals](#)
- Outstanding Communication - **Trey Daub & Ethan Lien** - [Have a Nice Day](#)

### Biomedical Sciences

- Outstanding Poster/Exhibit - **Hamza Ahmed** - [TAGGING IME4 in CANDIDA ALBICANS](#)
- Outstanding Communication - **Nikhitha Kastury** - [Methods of Senescence Induction in Human AC16 Cardiomyocytes](#)

### Natural & Physical Sciences

- Outstanding Poster/Exhibit - **Jennifer Lofgren** - [Optimization of superconducting quantum interference device performance through use of a "quick noise" measurement circuit](#)
- Outstanding Communication - **Cody Lewis** - [Assessing Zinc Tolerance in Fungi of Colorado](#)

### Social Sciences & Humanities

- Outstanding Poster/Exhibit - **Kristine Kohlmeier** - [Free Trade and The Great Exhibition of 1851](#)
- Outstanding Communication - **Katelyn Stollsteimer** - [Does the early bird actually get the worm? A review of time of day effects and individual differences on cognitive tasks](#)

### Tech, Engineering, & Math

- Outstanding Poster/Exhibit - **Daniil Arushanov, Cesar Ramirez, Artsiom Skarakhod, Kaitlyn Nugent** - [aTA \(artificial TA\): A Closed-Domain Long-Form Question-Answering Chatbot](#)
- Outstanding Communication - **La-Doniea Nisbeth** - [FinTech & Positive Social Impact: Jamaica Meets Bly](#)

## ORAL SESSION CATEGORY AWARDS

- Arts & Media - **Alison Chen** - [Indigenous Taiwanese Tattoo Traditions: Paiwan](#)
- Social Sciences & Humanities - **Ricky Abilez** - [Regulating Facebook: Holding the Social Media Giant Accountable for It's Unprecedented Influence in Our Democracy and Our Lives](#)
- **STEM** - **Alexandra Ramirez** - [Defined power limits prevent cellular damage during longitudinal in vivo 3-photon imaging of mouse cortical gray and white matter](#)

## SPECIAL RECOGNITION AWARDS

- Emphasis on Interdisciplinary Collaboration - **Julianna Wright, Ryan Lavalley, Jamie Young, Dennis Mills** - [Play With Your Food](#)
- Equity Serving Research or Creative Activity - **Jessica Valdez** - [COVID-19 & Police Perceptions: A Qualitative Study of Perceptions of the Police that includes the Asian-American/Pacific Islander Community](#)
- Impact in the Denver Metro Region - **Amanda Rees** - [Legacies of the Denver Project: The Valley Highway](#)
- Innovative Use of Technology - **Alexander Kimose, Davina Vetter-Drake, Christopher Probst** - [B.M.O. - Filmmaking Through Digital Puppetry](#)

## PEOPLE'S CHOICE AWARDS

- **Keira Richards** - [Cowntown Counterculture: A Historical Analysis of the Punk Scene of the Colorado Front Range in the late 1970s](#)
- **Kaysie Larson, Allyson Olson, Ivonne Jacob-Flores** - [Re-Envisioning Space on Auraria Campus](#)

# RACAS 2022 ABSTRACTS

## *Alphabetical by Title*

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### **1900 Colorado's Last Gold Rush**

Paul Bowen, *Social Sciences & Humanities*

Mentor: Professor James Walsh

#### Abstract:

Using primary sources from Ancestry.com, the goal is to recreate gold mining towns from 1900 using 1900 US Federal Census Data. I was inspired by a course titled *Irish Diaspora*. This project is about the people and not about the gold.

My area of interest is Cripple Creek and Victor, Colorado. In 1900, as many as 8,000 gold miners were in Teller County, Colorado. At first I thought 16,000+ people lived in the area. After reading up on the area, an additional 9,000 people were not included. Approximately 15 other ghost towns were removed from open-pit mining operations conducted in the 1970's. Today this open mine after 50 years can be seen from space photography. What remains are the towns of Cripple Creek and Victor. Today the towns share a public high school, with a recent graduating class of 15-20 people. This was the same rate of high school graduates in 1900.

I can record at a rate of fifty people per hour, then refine the list of families to map out neighborhoods of the period. Recent interest in Irish communities has concentrated my research in 1900 Victor, Colorado population 5,000+. I want to share that when studying labor communities, it is important to seek records outside of Ancestry, such as Catholic Marriages, Baptisms, and cemetery records. Project goal is to record 2,000 people living in Victor out of 5,000+ people who lived there.

I seek anomalies while recording, such as the three African-Americans who lived in 1900 Cripple Creek. That was three out of seven hundred predominately white European Americans. In that same data, I'm potentially identifying Colorado's early East European Jewish couples in Cripple Creek.

Before 1900, Teller County endured a labor war and three city-fires. After this research is complete this will be shared to the remaining residents of Cripple Creek and Victor with combined populations of about 2,200 people today.

<https://symposium.foragerone.com/2022-racas/presentations/45296>

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### **Addiction Beyond the Numbers: Using Layperson Addiction Attitudes to Shape Addiction Modeling**

Eliana Safer, *Social Sciences & Humanities*

Mentor: Lance Dean

#### Abstract:

Addiction of many kinds (drugs, alcohol, pornography, sex, gambling, cutting, etc.) has long posed a physical, mental, and emotional threat across countless demographics. While originally viewed as a personality flaw, more recent conceptions consider addiction a mental health disorder. With current genomic and social science advances, genetic sequencing and microscopy have identified genes and DNA-associated proteins potentially involved in addiction. Neurobiological and psychosocial analyses have more clearly defined personality traits including risk-taking and impulsivity in addictive behavior. Furthermore, increasing mental health awareness has highlighted the role of trauma, especially in childhood, and stress in addiction. Given the myriad of possible factors causing addiction, this study aimed to examine current public perceptions of addiction across varying demographics. The study looked for correlation between age, field of study, previous experience, addiction knowledge, and occupation

and attitudes toward addiction based on surveys distributed using Facebook, Instagram, GroupMe, and email among University of Tennessee students, faculty, and the greater community. Major findings include general attributions of mental health and genetics and belief in a limited span in which an addict will consent to treatment. However, a surprisingly prevalent believed cause was the need to escape or hide from some element of life. Thus, this research argues for a qualitative addition to addiction treatment including psychoanalysis of any real or perceived being the patient feels enslaved to. While psychological models capture such issues, the phrasing of the issue as a means of escape may more accurately encompass and acknowledge the qualitative experiences of the addict.

<https://symposium.foragerone.com/2022-racas/presentations/46626>

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### **A Method for Predicting Adverse Drug Reactions of Withdrawn Drugs Using Molecular Docking**

Catherine Aber, Alex Plonski, *Biomedical Sciences*

Mentor: Dr. Scott Reed

#### **Abstract:**

As medicine has taken a more holistic approach to provide patient care, the field has seen the expansion of personalized medicine, which aims to provide more personalized approaches to patient care. A subset of personalized medicine is pharmacogenomics, which seeks to analyze how differences between people's genomes can predict individual reactions to drugs. The objective is to avoid giving people drugs that are less effective or can lead to adverse drug reactions. This project aims at creating a method to understand adverse drug reactions from drugs that have been withdrawn from the market. From this, it is hoped that new adverse interactions with drugs can be avoided. We have generated a small molecule library of 236 withdrawn drugs along with their predicted metabolites, totaling over 19,500 molecules. We have selected a group of 68 proteins and their variants to conduct molecular docking studies using the program QuickVina-W. These proteins are provided by Novartis, which is an in vitro safety pharmacology profiling group that designs binding assays for the targets on its safety panel. The targets were selected after a review of clinical study findings provided evidence for their roles in adverse reactions. Our goal is to analyze all possible drug-protein interactions computationally and determine a method for distinguishing potentially significant interactions which may point towards mechanisms for adverse drug reactions.

<https://symposium.foragerone.com/2022-racas/presentations/45535>

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### **A review of criminal justice sentencing goal outcomes**

Casey Swatowski, *Social Sciences & Humanities*

Mentor: Dr. Lindsey Hamilton

#### **Abstract:**

The desired outcome of society is to be healthy, productive, and prospering. Crime is an ever-present detraction from that outcome goal both for the victims of crime, the perpetrator, and their families. Thus, the desired outcome of the criminal justice system stands to be reasoned as a crime free society to the best extent possible.

To accomplish this the criminal justice system has five sentencing goals or methods to accomplish crime reduction and society's demands: retribution, deterrence, incapacitation, rehabilitation, and restoration. While each one of these may have its use in particular situations to serve particular needs, most provide inadequate reductions in recidivism and have been actually implicated in increasing recidivism rates. The exception is rehabilitation, which has shown significant reductions of recidivism rates. While there is debate about which forms and methods of rehabilitation are more effective, a consistent theme is that virtually all forms of rehabilitation show net benefit levels of recidivism. The goal of the paper, this presentation is abridged from, is to enlighten the general public, recommend future research, and help push criminal justice reform towards rehabilitation.

<https://symposium.foragerone.com/2022-racas/presentations/45500>

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## **A Social Behavior Comparison of Fear and Buffering in Female Juvenile and Adult Rats**

Naomi LaPointe, *Biomedical Sciences*

Mentor: Dr. Sondra Bland

### **Abstract:**

Social fear is a behavioral and neural expression of arousal to a fearful, painful, or threatening social stimuli, whereas social buffering (resiliency) is defined by the reduction of fear response produced by a social cue in the presence of a fearful stimulus. Social fear and social buffering studies primarily consist of male populations, and rarely engage in comparative analyses with or between female populations and differing age groups. Expanding social fear and buffering research to sex and age differences could progress the understanding of the prevalence, rates, and mechanisms of disorders such as post-traumatic stress disorder (PTSD) and social anxiety disorder (SAD), between female adolescent and adult populations. Among adolescents, some research suggests the prevalence of these disorders is lower than that of adults, though the literature remains inconsistent. This study aims to add to the body of knowledge on the sexually dimorphic and developmentally related differences of social fear and social buffering between female adolescents and adults. We predict that juvenile females will display greater social buffering compared to adult females. To test our hypothesis, juvenile and adult female rats received a series of foot shocks (day one), with half randomly assigned a matched conspecific social stimulus rat, which either provides fearful or buffering cues both during the conditioning trials and upon re-exposure to the context (day two). Freezing behavior was assessed as a measure of fear. There were no group differences on Day 1, however, on Day 2 there were significant main effects of age, time, and social stimulus. Adults froze less than juveniles, and animals with a social cue froze less than those without. Overall freezing decreased over time. Results did not support our hypothesis, which may be due to female juvenile rats failing to extinguish the fear memory.

<https://symposium.foragerone.com/2022-racas/presentations/45466>

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## **A-SIMA: Advanced Support with Integrative Metabolite Analysis for 2D NMR**

Abigail Chiu, *Natural & Physical Sciences*

Mentor: Dr. Woonghee Lee

### **Abstract:**

Metabolomics is the study of metabolites -in other words, small molecules in an organism- to describe the organism's physiological state. The two major methods in the analysis of metabolites are nuclear magnetic resonance (NMR) spectroscopy and mass spectrometry (MS). Compared to mass spectrometry-based, NMR-based is more reproducible and less sensitive. In NMR method, 1D  $^1\text{H}$  NMR experiment is used for quantification by integrating peak volumes, while 2D  $^1\text{H}$   $^{13}\text{C}$  Heteronuclear Single Quantum Coherence (HSQC) NMR experiment is used for qualification through metabolite identification because it is the fingerprint of the compound. However, the process can become tedious when trying to do unknown identification with a sample. Usually, a user would compare an unknown sample to many standard compounds' HSQC data to find its identity by overlaying the spectra and eyeballing peaks one-by-one. Therefore, this research aims to develop a novel computational method to automate the comparison of 2D  $^1\text{H}$   $^{13}\text{C}$  HSQC NMR spectra for unknown metabolites identification. Users can have interactive communication with the Biological Magnetic Resonance Bank (BMRB) database using the developed software. It allows for users to choose the peaks on the computer screen with the click of a few mouse buttons. A graphical user interface (GUI) queries the compound library set and provides probable candidates with their likelihood values. Furthermore, the GUI can automatically overlay the HSQC of the predicted hit chosen by the user on to their sample data for an easy visual verification. With this new program, the user can identify unknown metabolites via a novel predict-and-confirm method.

<https://symposium.foragerone.com/2022-racas/presentations/45740>



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## **Access to Specialty Care for Medicaid or Uninsured Patients**

Maydha Kumar, *Social Sciences & Humanities*

Mentor: Dionisia De La Cerda

### **Abstract:**

It has been known that health care can be very expensive, to the point that one in five Coloradans refuse care because of the cost. The main explanation for why health care is expensive is due to uncompensated care (when doctors give treatment without being paid). However, uncompensated care rates have been at historic lows, and yet the cost of care in Colorado is growing faster than the Nation's. This seems counter intuitive especially when there were policies implemented in 2009 to taper the cost of health care. The unexplained increase has been deemed an area to be researched by the CHASE Board. This project will investigate the increase in prices from the hospital side and discover what Coloradan's value in a health care system to help take further steps in reducing the cost of health care.

<https://symposium.foragerone.com/2022-racas/presentations/45533>

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## **Age Differences in Rats When Expressing Social Conditioned Fear or Social Buffering as a Result of Foot Shocks with a Social Cue**

Makayla De La Oliva, *Biomedical Sciences*

Mentor: Dr. Sondra Bland

### **Abstract:**

Stress-related disorders can be debilitating. People develop these disorders because of early life adversity and traumatic experiences; however, not everyone who experiences stressful or traumatic events will develop a stress-related disorder (Dawud, 2020). It is important to study the behaviors and brain activity associated with these disorders so that they can be used to help people who suffer from them. Previous research has shown that rats either experience social conditioned fear or social buffering when placed in stressful situations while in the company of another rat. Social buffering occurs when a social animal is in the presence of another member of its own species during a stressful event and its acute stress responses are eased because of it (Kiyokawa et. al., 2014). Social conditioned fear is displayed when the rat associates the stressful situation with the other rat and becomes scared of that rat as a result. The aim of this study was to determine whether there were age differences in rats who expressed social buffering effects during stressful situations. This experiment compared male adolescent rats (postnatal day 42) to male adult rats (postnatal day 90). The groups included rats who received four foot shocks with a social cue and rats who received four foot shocks without a social cue. Then to determine whether social buffering effects were present, freezing behavior was assessed during the interstimulus intervals and then the next day during re-exposure. Freezing behavior was significantly reduced when the rats were in the presence of a social cue. Our data suggest that there were robust social buffering effects regardless of age in male rats. However, freezing behavior was not significantly different between the two age groups. Overall, the results indicated that there were not any age differences in terms of social buffering effects in male rats.

<https://symposium.foragerone.com/2022-racas/presentations/45459>

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## **American Oddballs of the Pacific: The Guano Islands and the Origins of the United States Maritime Empire**

Mark Ortiz, *Social Sciences & Humanities*

Mentor: Ryan Crewe

### **Abstract:**

The passage of the Guano Islands Act in 1856 marked the official beginning of United States overseas territorial annexation. The act permitted U.S. citizens and businesses to possess guano-rich unoccupied islands and to make them appurtenances of the United States. The guano rush of the nineteenth century reveals that American private enterprise obtained assistance from the federal government in advancing its interests while federal officials encouraged commercial incentives to further national policy. Study of the guano trade tells of how involved the federal government was in the nation's agricultural and mercantile ambitions to acquire massive avian fertilizer deposits. In this nexus there was little evidence of *laissez-faire*. Instead, the story reveals the myth of *laissez-faire* in nineteenth century America as the U.S. government pursued an activist public policy that benefitted American enterprise. The Guano Islands Act provided legal and maritime protection for American entrepreneurs mining guano - desiccated seabird excreta (the white gold of seabirds). The foremost Pacific Islands claimed under the Act include Baker, Howland, Jarvis, Kingman, Johnston, Palmyra, and Midway. The "guano mania" of the mid-nineteenth century led to a guano rush in the Pacific. This development in turn led to the precedent of U.S. claimed maritime sovereignty over insular areas. As such it was the founding act of the United States' seaborne imperialist endeavor. United States overseas acquisitions began with guano islands claims. The 1856 law made it legal to seize islands if they had lots of bird poop. The Pacific Remote Areas (PRIA) is an endorsement of American expansion that is overlooked in nineteenth century American history because it was maritime across the Pacific rather than overland across the continent.

<https://symposium.foragerone.com/2022-racas/presentations/45661>

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## **An Exploration of University Services for Increasing Student Outreach and Retention**

Dana Mallozzi, *Arts & Media*

Mentor: Dr. Keith Guzik

### **Abstract:**

The college experience is continually evolving as new groups of students enter the university and schools look to engage them. Attracting and retaining students is understood to be critical to the success of higher education institutions. A phenomenon closely related to retaining first-generation and continuing-generation students is the student-parent experience. Accessible childcare is essential to institutions of higher education. It helps students go to college, graduate, find jobs, and earn more in their lifetime. It allows colleges to attract the best faculty and staff. It helps strengthen our nation through lasting economic and social benefits. The literature on college services is replete with references to TRIO, a series of eight highly successful federally funded programs established to help low-income individuals enter college, graduate, and contribute to society. Few investigations have evaluated the impactful role of the Child Care Access Means Parents in School Grant Program that supplements tuition to support and establish campus-based childcare. Its impact is mighty. Even so, CCAMPIS is studied and cited in thinly dispersed education journals; and it remains little known. The majority of studies have approached the subject from an educational perspective; I am proposing a sociological study using qualitative methods to investigate the positive outcomes of the coalition between TRIO and CCAMPIS programs that often serve the same students and share the same goals in retaining them. This research design would consider the topic from a broader perspective, not just student's educational needs but also their human and social needs.

<https://symposium.foragerone.com/2022-racas/presentations/45481>

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## **An Investigation of Attentional Capture at the Fovea**

Dylan Kammerzell, *Social Sciences & Humanities*

Mentor: Carly Leonard

### **Abstract:**

How do we focus our attention? Motion detected out of “the corner of our eye” can draw attention, but then the eyes typically shift to bring that object to central vision (the fovea). So, if information in foveal vision is primarily where attention is focused, how much attention can be disconnected from that area? This relates to the attentional capture debate, which investigates the factors that determine what is really capturing or grabbing attention. Some theorize that relevancy to a goal causes certain distractors to capture attention more (like looking for a friend in a red shirt, then noticing other people wearing red clothing). Another theory is that a distractor’s contrast matters most, or how much it stands out from the rest of the scenario (like a colorful tree on a grey background). Many earlier experiments have used paradigms with peripheral distractors, but few have focused on distractors at the center of vision. If a task only asks for responses based on information in peripheral vision (the non-center of vision), how much attention could be pulled away from the point of fixation? This presentation will discuss literature on attentional capture, and then propose a new experiment relating to these ideas. <https://symposium.foragerone.com/2022-racas/presentations/45488>

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## **Assessing Zinc Tolerance in Fungi of Colorado**

Cody Lewis, *Natural & Physical Sciences*

Mentor: Dr. Sara Branco

### **Abstract:**

Soil heavy metal contamination due to anthropogenic activity negatively impacts organisms (1). Finding native metal tolerant fungi can assist in habitat recovery, which is direly needed given the history of mining and the contamination in the American West. Previous work has shown Fungi in Europe to have evolved tolerance to several metals and protect their pine partners from soil toxicity (2). Twenty-nine isolates of Coloradoan fungi were grown in Zinc gradient media to assess their tolerance to metal concentrations. Using multiple species from the *Suillus* genus, isolates were measured for growth after 14 days and compared to the growth of controls. I identified multiple isolates of different species that were tolerant to high zinc levels and multiple isolates from those same species that were sensitive to the same concentrations. These findings suggest possible candidates for future comparative genetic research. Identifying additional tolerant and sensitive isolates will allow our lab to genetically compare the mechanisms evolved for zinc tolerance across and within species of *Suillus*. In the future, we will assess whether tolerance to other metals such as copper and nickel also evolved in *Suillus* from Colorado and pave the way for comparative studies addressing the mechanisms of fungal soil metal tolerance. <https://symposium.foragerone.com/2022-racas/presentations/45503>

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## **aTA (artificial TA): A Closed-Domain Long-Form Question-Answering Chatbot**

Daniil Arushanov, Cesar Ramirez, Artsiom Skarakhod, Kaitlyn Nugent, *Tech, Engineering & Math*

Mentor: Farnoush Banaei-Kashani

### **Abstract:**

Recently, with the release of its sparse-attention Routing Transformer (RT), Google has achieved state-of-the-art results on the natural language processing (NLP) task of open-domain long-form question answering (LFQA) [1]. While demonstrating dominating performance in open-domain LFQA (i.e., in automatically generating long and coherent answers to user questions in an any/open knowledge domain), because of its generic and open-domain nature, this chatbot often fails to generate accurate and meaningful answers. In this project, we extend this work by

introducing a generic data curation workflow along with the curated datasets that allow for domain-specific training of the aforementioned chatbot for closed-domain LFQA. Our goal is to restrict the problem size down to individual domains to improve answer generation quality, yet simultaneously provide an automated framework to train chatbots that are well versed across 165 domains. In particular, as a case study, we use our proposed workflow to generate a chatbot that is specialized to answer questions on the topic of “data science”.

<https://symposium.foragerone.com/2022-racas/presentations/45840>

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### **Autistic Traits Clustered Within the Adult General Population and STEM**

Christian Olivencia, *Social Sciences & Humanities*

Mentor: Dr. Albeck

#### **Abstract:**

Since its first diagnosis in 1980, Autism Spectrum Disorder has been primarily viewed within the unitary spectrum model. In popular culture, some people will refer to others as “on the spectrum”. However, recent studies have challenged this notion of a unitary spectrum. Given the validity of those studies, adoption of a 2-cluster model of autistic traits has been proposed, one that can potentially improve the diagnostic process. We attempted to replicate the results of Palmer in his “‘Subtypes’ in the Presentation of Autistic Traits in the General Adult Population” study and to draw our own novel conclusions. Cluster 1 is associated with greater social difficulties and weaker detail orientation, while cluster 2 is associated with fewer social difficulties and higher detail orientation. For one hypothesis, we predicted that those in Cluster 1 would be more likely to be males working in or studying STEM fields compared to those who fall into Cluster 2, and that those within Cluster 1 will be more aroused by images containing objects. Our data was collected through online surveys (N = 325) utilizing the AQ, The SAMS’s, and IAPS. Our methods included a hierarchical cluster analysis utilizing Ward’s method; this revealed and replicated the 2 clusters proposed by Palmer. Higher AQ score were significantly associated (using chi square) with being in cluster 1 (p be two separate spectrums, and the implication of that has yet to be seen.

<https://symposium.foragerone.com/2022-racas/presentations/45283>

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### **B.M.O. - Filmmaking Through Digital Puppetry**

Alexander Kimose, Davina Vetter-Drake, Christopher Probst, *Arts & Media*

Mentor: Eric Jewett

#### **Abstract:**

Within the last 25 years, the advancement of Computer-Generated Imagery has made it easier for filmmakers and digital artists to bring large monsters to life and the trail of destruction they leave behind. Advancements within the last 10 years by companies such as Adobe, Blender, Disney Renderman, and Unreal Engine have also made Computer Generated Imagery much more financially achievable for independent and student filmmakers, compared to the millions spent by Hollywood studios. However, the timeline put into the process of creating fully realized CGI characters and their complex movements can take up to 10 months, an unrealistic timeline for a student film project (which only has 8 months total for each facet of production from casting to premiere). Our team has experimented in merging the art of puppetry with Computer Generated Imagery to bring to life a building-sized crab that destroys a city in the short film *B.M.O.* A Denver-based puppeteer took three months to craft the crab as a puppet. Utilizing cardboard and styrofoam, the puppet has seven fully adjustable legs and two arms. After completing its final design, the puppet was filmed in a studio space as a reference to the puppet’s mobility and range of directions for our VFX supervisor. The puppet was then scanned with high resolution photos and imported into Blender, where the puppet was digitized into a full-scale, CGI model. We will be exploring how utilizing Blender and Adobe After Effects impacts the digital puppet and the full range of control we have over the crab as it destroys a completely digital cityscape.

<https://symposium.foragerone.com/2022-racas/presentations/45518>

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## **Bacterial pathogens found near wastewater effluent points studied through high throughput metagenomic sequencing method**

Alyssa Cruz, *Natural & Physical Sciences*

Mentor: Christopher S. Miller

### **Abstract:**

Pathogenic bacteria from environmental sources pose a significant risk towards public health. Wastewater treatment plant (WWTP) effluent points serve as potential reservoirs for human pathogens that have survived the conventional activated sludge (CAS) method. CAS is typically done to remove nutrients and organic molecules as a secondary removal step. Particle pathogen interactions have been shown to negatively affect the success of wastewater disinfection; however, few studies have examined these interactions and a knowledge gap remains. Traditional WWTP monitoring and surveillance rely on single and multiple species analysis resulting in inadequate information on the overall microbial composition of the effluents leaving the site. Utilizing the Next-Generation Sequencing method, metagenomics, large-scale microorganism identification can be completed. This method provides the metabolic potential of these effluents, as it encompasses the genetic background of all collected microbes. The way pathogens from these effluents persist into downstream surface water is underexplored. Using the surface water data samples from the Genome Resolved Open Watersheds project, we are characterizing the pathogenic potential of samples taken from varying freshwater ecosystems within range of a WWTP effluent input across North America. High throughput metagenomics was conducted, the sequences were assembled, and protein-coding genes were inferred. Biological sequence similarities are being found using BLASTP against the Virulence Factor Database (VFDB) for medically significant pathogenic bacteria, and MetaPhlan 3.0 (Metagenomic Phylogenetic Analysis) is being used for microbial composition profiling. It is hypothesized that the microbial composition at sites most impacted by the effluents will include larger amounts of bacterial pathogens that have survived the WWTP disinfecting methods. Additionally, we are exploring other freshwater ecosystems not directly affected by WWTP effluents for pathogen load out to better understand the distribution of virulence genes. This study offers insight into microbial surveillance for human pathogens resulting from WWTP effluent points into freshwater ecosystems.

<https://symposium.foragerone.com/2022-racas/presentations/45655>

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## **Biliterate Writing Development**

Luz Moreno, *Social Sciences & Humanities*

Mentor: Adriana Alvarez

### **Abstract:**

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

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

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

With a focus on metalinguistic awareness, we look for the connections between the two languages in students' work and the ways in which they aid in advancements within both languages. A qualitative study, we code students' writing

to contribute to an understanding of their phonemic awareness progression. In addressing these elements in the reading and writing of students presently studying in the realm of Spanish/English education, context can be provided into the development of these skills concurrently.

I argue that the presence of certain overlapping between languages in students' writing can prove to aid in their journey in phonemic awareness in both languages within a school year.

This project closes in on a major point brought up against Bilingual Education and exemplifies a major component of education in any language: reading development.

<https://symposium.foragerone.com/2022-racas/presentations/45551>

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### **Can Early Sensory Brain Activity Predict Individual Eye Movement Behavior?**

Tamar Japaridze, *Natural & Physical Sciences*

Mentor: Carly Leonard

#### **Abstract:**

When asked to find a simple geometrical figure among smaller distracting figures on a screen, people move their eyes in unique and characteristic ways. Using eye-tracking, our lab found one such difference between individuals in how long they hold their gaze still after the search display first comes on before eventually moving their eyes to a new location. Interestingly, this initial fixation duration seems related to how efficiently people search the screen for the figure. Namely, those people who wait longer to move their eyes land much closer to the figure when they *do* move their eyes. Furthermore, such people take fewer overall eye movements to find the figure. This more successful performance among individuals with longer average first fixation durations suggests that the longer wait to first move the eyes provides advantages. How can holding the gaze longer provide advantages in search? A longer wait likely allows people to process more area of the screen, approximately locate a potential figure in the periphery, and plan a more accurate eye movement in that direction. To elucidate the neural processes that may underlie differences in the first fixation, our lab recently started using electroencephalography (EEG) to measure people's brain activity while they perform this search task. Specifically, we are looking at neural components that correspond to early sensory responses. We are interested in whether these early brain responses during the initial fixation can predict when, how, and where people will next move their eyes. Finding a relationship between brain and eye activity will help us uncover in more detail, as well as provide concrete evidence, on the proposed processes underlying the search advantage in longer first fixation durations. This presentation will present early findings from the experiment.

<https://symposium.foragerone.com/2022-racas/presentations/45651>

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### **Cloning Glucose-6-Phosphate Isomerase (GPI) and Determining the Effects of Endoplasmic Reticulum Retention on Pluripotency**

Hannah Abroe, *Biomedical Sciences*

Mentor: Christopher Phiel

#### **Abstract:**

We have identified a novel protein in the regulation of stem cell pluripotency, Glucose-6-phosphate isomerase (GPI). GPI is a protein involved in glycolysis, it catalyzes the conversion of glucose-6-phosphate to fructose-6-phosphate. We have now been examining the mechanism by which GPI works to promote pluripotency. The Wnt signaling pathway is very important during embryonic development and we believe is involved in regulating pluripotency along with GPI. We believe the GPI receptor, GP78 is located on the endoplasmic reticulum (ER) and when GPI binds to this receptor it activates the Wnt pathway which promotes stem cell pluripotency. In order to test this hypothesis, we cloned a 4-amino-acid sequence ER retention factor to GPI with a Flag tag into the plasmid pCAGEN. There were

multiple steps required to complete this, including, PCR, TA cloning, and an LR reaction. With this ER retention factor, GPI should remain in the ER, and increasing the time bound to its receptor. The next steps are to determine if GPI is retained in the ER, if this localization promotes stem cell pluripotency. and whether or not this is due to activation of the Wnt pathway.

<https://symposium.foragerone.com/2022-racas/presentations/45823>

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### **Close To Home**

Kyra Collins, *Arts & Media*

Mentor: Carol Golemboski

#### **Abstract:**

I am constructing images using alternative lighting techniques to create interactions within my photographs, and I transform my environment by shooting portraits with vibrant colors. My portraits are based on memories I have experienced with my family and past conversations I've had with them. My portraits also have dream-like and imaginative qualities. Often, dreams include beliefs regarding an individual, different attributions and or expectations that relate to a specific mental image (Pagel, 174). In my work, I create different abstract lines with color, which enhances the dreamy qualities. Dreaming is important to share with the public as it helps me express my feelings, create bonds, and share interesting stories about my family. As part of my photographic project, I have taken a lot of inspiration from Man Ray. He was known for using dramatic lighting in his work, which created dark cast shadows and suggested movement (Hoving, 193). I use bright lights to create different painting strokes to allow the movement of the lights to create leading lines in my images. Photographing in the dark will allow me to shoot for a longer exposure time. Longer exposure times of at least 20 seconds allow for highly saturated colors, which changes the mood of the lighting (Miedza and Wollert, 89). These colors are not often achievable during the day. Saturated colors and brush strokes of light make my family stand out in their portraits. With this grant, I hope to express and interpret the meanings and importance of dreams and family.

<https://symposium.foragerone.com/2022-racas/presentations/45490>

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### **CO<sub>2</sub> Reduction on Cystamine Protected Gold Nanoclusters**

Jae-Hwan Lim, *Natural & Physical Sciences*

Mentor: Emilie Guidez Ph.D.

#### **Abstract:**

With climate change being an increasing threat, mitigating atmospheric CO<sub>2</sub> is of dire importance. This investigation explores Au<sub>25</sub>(SR)<sub>18</sub><sup>q</sup> [ $q = -1, 0, +1$ ] (SR = SCH<sub>2</sub>CH<sub>2</sub>NH<sub>2</sub> cystamine ligand) nanoclusters as catalysts for the reduction of CO<sub>2</sub> into CO in the gas and aqueous phase, using Density Functional Theory (DFT) computations. Preliminary calculations show that the charge  $q$  of the nanoclusters in both water-solvated and non-solvated systems had a significant effect on the binding strength of CO<sub>2</sub>. The Au<sub>25</sub>(SR)<sub>18</sub><sup>-</sup> and Au<sub>25</sub>(SR)<sub>18</sub> possessing complexes, typically in the gaseous phase, had the lowest HOMO-LUMO gaps, suggesting they may be more reactive. Additional calculations showed that the Au<sub>25</sub>(SR)<sub>18</sub>(CO<sub>2</sub>)<sup>q</sup> isomer complexes with the lowest energy correlated with a bending of the O-C-O angle of the CO<sub>2</sub>. This bending occurs in complexes where the carbon from the CO<sub>2</sub> directly interacts with the nitrogen from the cystamine ligand of the gold nanocluster.

<https://symposium.foragerone.com/2022-racas/presentations/45554>

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## **Colorado Petroglyph 2022: Mammals**

Jacob Williamson, *Arts & Media*

Mentor: Travis Vermilye

### **Abstract:**

In retrospect, the artists of the ancient world were not intending to create a catalogue of extinct species - but that is now an unignorable aspect of the petroglyphs they left behind. Mammut americanum, bison antiquus, and euceratherium collinum (all now extinct among many others) were depicted in iron-oxide on illuminated stone faces because they were important, worthy of recognition, to the people who once lived here. I believe that nothing has changed concerning this experience of Coloradan's existence, only the animals that we share it with. My work is wholly influenced by the natural world and its sustainability. Likewise, my materials also honor our current co-Coloradans with equal respect.

Colorado Petroglyph 2022: Mammals uses methods inspired by the Sioux people (although not exclusive to them): Burned willow wood, found iron-oxide concretions, and free-range chicken eggs on sandstone - along with other natural minerals and surfaces. Each depiction is sized true to life.

<https://symposium.foragerone.com/2022-racas/presentations/45654>

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## **Comorbidities in Cardiac Arrest Patients**

Hosbaldo Morales, *Biomedical Sciences*

Mentor: Shelby Shelton

### **Abstract:**

In the US, 475,000 people die from cardiac arrest each year. The University of Colorado Hospital treats around 200 cardiac arrest patients each year. In 2016, the Colorado Cardiac Arrest Registry (CCAR) was created to capture cardiac arrest data with the intention of improving clinical outcomes. Data such as demographics, past medical history, and event logs relating to out of hospital or in hospital events are recorded into the registry. CCAR was approved by COMIRB (COMIRB #16-0137) as non-human subject research. Data is retrospectively recorded by trained research assistants from the Epic electronic medical record and entered into the REDCap database. We examined 1,345 cardiac arrests between July 1, 2013, to February 22, 2022. From our database, 61.8% of these patients had a history of hypertension, 22.4% had coronary artery disease, 25.0% had hyperlipidemia, 12.6% had a previous myocardial infarction, 20.0% had congestive heart failure, 4.0% had peripheral vascular disease. Looking at discharge outcomes 78.2% of patients did not survive to discharge, 4.8% were moved to a skilled nursing facility, 13.2% were discharged home, 2.8% were transferred to another hospital, and 1.1% were moved to hospice. Our dataset also looked at patients who had different comorbidities. Chronic pulmonary diseases such as chronic obstructive pulmonary disease (COPD) and asthma were the most common comorbid conditions, with 48.2% of the cohort having at least one chronic pulmonary disease. Congestive heart failure was the second most common heart-related comorbidity at 23.6% of the cohort. From these results, we can see that over half of the cardiac arrest patients have hypertension and other heart and lung conditions, which are known to be risk factors for developing a cardiac arrest. CCAR registry has allowed us to interpret this data to learn more about cardiac arrest relating to past medical history, comorbidity, and discharge outcomes.

<https://symposium.foragerone.com/2022-racas/presentations/45995>

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## Compassion Cultivation in Acute Migraine Pain Management: Results from a Pilot Study

Dustin Goerlitz, Amy Wachholtz, *Social Sciences & Humanities*

Mentor: Amy Wachholtz

Abstract:

**INTRODUCTION:** As research on psychosocial interventions for pain management has evolved, there has been a larger focus on preventative management than acute management. This is particularly the case for migraine pain management. From a psychosocial standpoint, one area showing promise for acute management is compassion cultivation. Loving-kindness meditation (LKM) is a specific compassion cultivation method with encouraging results from a small number of pilot studies on pain management. In the present study we hypothesized weekly migraine pain intensity to be significantly less compared to baseline, over the course of a 4-week group LKM intervention.

**METHOD:** 89 meditation naïve participants [ $M_{\text{age}}=41.8$  years ( $SD=12.72$ ), 80.7% female, and 85.2% Caucasian] were recruited from the New England region. Participants were 18+ years-old, reported 2-10 migraines per month confirmed by their PCP, and confirmed at least 66% of items on a migraine screener. The intervention consisted of 4 weekly group-LKM sessions. Migraine pain intensity was collected immediately before and after each weekly session via a 0-10 pain thermometer. The present study analyzed weekly post-session migraine pain intensity. Difference in weekly migraine pain was assessed via a linear mixed model. **Results:** The model showed a significant effect of time on weekly pain scores,  $F(4,82.717)=10.70$ ,  $p < .001$ , with a 0.44 proportional reduction in variance (PRV) from the null model at level 1 and a 0.126 PRV at level 2. 84.8% achieved a clinically meaningful difference (i.e.,  $\geq 33\%$  change) in pain. Bonferoni corrected post-hoc comparisons showed baseline pain to be significantly different from timepoints 1, 2, 3, and 4 all at the  $p < .001$  level. There were no significant differences between any subsequent timepoints (i.e., timepoints after session 1). **DISCUSSION:** Our results indicate significant and clinically meaningful acute migraine pain management can be achieved via a brief LKM intervention. Importantly, pain reduction achieved after session 1 was held stable through session 4. This indicates LKM can be quickly learned, effectively implemented, and produce continued benefit for acute pain management. As the present study utilized pilot data, fully powered studies are encouraged toward examination of likely mechanisms (e.g., anger, anger expression, and emotional tension).

<https://symposium.foragerone.com/2022-racas/presentations/45537>

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## Computational examination of gold nanoclusters use for syngas production

Iman Salhi, *Natural & Physical Sciences*

Mentor: Emilie Guidez

Abstract:

This investigation examines the role of gold nanoclusters  $Au_{25}(SPhX)_{18}^{-1}$  with varying ligands, as a catalyst for the reduction of carbon dioxide and the formation of syngas using Density Functional Theory computations. Initial computations suggested that throughout negatively charged  $Au_{25}(SPhX)_{18}^{-1}$  clusters in both solvated and non-solvated environments, the cis/trans conformation of the gold clusters had an effect on the overall energy of formation. The lower the overall energy of the complex, the easier it may be for the  $CO_2$  to reduce and form CO. DFT calculations indicated that the HOMO-LUMO gap is smallest in the Cis- $Au_{25}(SPhBr)_{18}$  (#2) configuration for both solvent types. The relative energy is smallest as Cis- $Au_{25}(SPhBr)_{18}$  (#4) configuration for the water solvated phase and smallest as Trans- $Au_{25}(SPhBr)_{18}$  (#1) non solvated phase. The negatively charge clusters were run due to their likelihood of being more efficient. This is attributed by the stability of the negative charge which gives rise to a closed shell. The negatively charged cluster ensured that there were free electrons that could ensure the reduction of carbon dioxide to from syngas. The cis/trans conformation of the different complexes allowed for the reaction to proceed with the overall lowest amount of energy use.

<https://symposium.foragerone.com/2022-racas/presentations/45520>

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## **Computer Vision-based NMR Strip Matching for Backbone Chemical Shift Assignments**

Zowie Werner, *Natural & Physical Sciences*

Mentor: Dr. Woonghee Lee

### Abstract:

NMR stands for Nuclear Magnetic Resonance, and NMR Spectroscopy is one of the most popular biophysical techniques used to denote the structures and dynamics of a protein in a cellular physiological-like state at the near-atomic level. NMR spectra are analyzed using an NMR instrument by measuring and observing the resonance signals. Our lab group develops the POKY suite, which is the modern automated and integrated software suite for NMR-based biomolecular studies. One of the most challenging aspects of NMR Spectroscopy is NMR Assignment. This is matching the NMR signal to an atom of a protein. This can be accomplished with either the walking forward or walking backward method, which necessitates peaks picked on the spectra by the individual user. It is impossible to employ these strategies because of peak overlaps, weak signals, peak broadening, and more. To tackle this common problem, we aim to adopt and develop computer vision-based image matching algorithms that will eliminate the need for the peaks to be picked by the individual user. The images can go through a similarity check by assuming the peaks as images, so the user does not need to pick peaks with the walking forward or backward method. With the development of this novel technology, NMR-based protein structure research will be accelerated and flourished.

<https://symposium.foragerone.com/2022-racas/presentations/45477>

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## **COVID-19 & Police Perceptions: A Qualitative Study of Perceptions of the Police that includes the Asian-American/Pacific Islander Community**

Jessica Valdez, *Social Sciences & Humanities*

Mentor: Dr. Melissa Tackett-Gibson

### Abstract:

Over the last decade, police-community relations have been strained due to perceptions that law enforcement are racist and target minorities using lethal force excessively. To rebuild those relations, it is necessary to understand how citizens perceive the police, the causes of these perceptions, if these views are based on accurate data, and how we can begin to change these perceptions. A review of multiple studies regarding these topics indicates that perception of effectiveness of the police, as well as perceptions about crime and safety were strong predictors of how satisfied citizens were with the police, and how common they thought misconduct was in their neighborhoods. Additionally, mainstream media is one of the foremost sources of information about law enforcement. However, many studies of police perceptions were done before the year 2020 and primarily address Black, White, and Hispanic/Latino populations, failing to include Asian-American/Pacific Islander views. This is even more relevant to study considering the increase in hate crimes towards the Asian-American/Pacific Islander community because of COVID-19, and how that may have affected police perceptions. Moreover, the concept of prosecuting a hate crime is also something relatively new to the criminal justice system. The first federal statutes were not passed until the 1980s, and corresponding state laws followed in the 1990s. Through surveys and interviews, this project aims to understand the current views the Asian-American/Pacific Islander community has regarding law enforcement. The influence of race, pre-Covid personal experiences with the police, and experiences with the police when reporting a hate crime will be examined. This presentation will examine results from a pre-test of a survey of Asian-American/Pacific Islander students and volunteer participants recruited from online forums that was administered so the final survey can be refined. This presentation also discusses the pre-test process and subsequent changes to the final survey.

<https://symposium.foragerone.com/2022-racas/presentations/45509>

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## **Cowtown Counterculture: A Historical Analysis of the Punk Scene of the Colorado Front Range in the late 1970s**

Keira Richards, *Social Sciences & Humanities*

Mentor: Dr. Rachel Gross

### Abstract:

Cowtown Counterculture is a historical analysis of the Punk Movement of the Colorado Front Range in the late 1970s. "Punk" is the self-prescribed moniker for a counterculture movement that began in the mid 1970s. The movement concentrated the disillusionment amongst adolescents with capitalism and the resurgence of conservatism. into social activism and Do-It-Yourself expressionism. The Colorado Front Range was home to a small but vibrant Punk scene which appears to have lacked some of the discrimination and violence present in larger scenes like Los Angeles New York, and the UK. Instead, The Front Range scene supported and allied with other marginalized groups like the LGBTQ and Latino communities. This entanglement of fringe groups is likely due the isolation, values, and limited population of Colorado at the time. This project, and its accompanying website, offers a new perspective on the local cultural heritage as well as the wider Punk movement.

<https://symposium.foragerone.com/2022-racas/presentations/45037>

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## **Dancing with Light: Recognizing Formalism in Western American Landscape Photography**

Claire Hay, *Arts & Media*

Mentor: Yang Wang

### Abstract:

Photography of the Western American landscape from its earliest inception to the present exhibits two main themes: one is a political, socio-economic, or environmental commentary; the other is a formalist response to the landscape via minimalist, abstract aesthetics. While the first theme has been well-addressed by contemporary scholars who view landscape photography through a socio-political lens, the aesthetic and formalist considerations of these photographs has been marginalized. To remedy this imbalance, this thesis examines the overlooked and undervalued abstract aesthetics of landscape photographs. Late 19<sup>th</sup> century images, such as those by Timothy O'Sullivan (1840-1882), were often created during government-conducted surveys of the interior west to ascertain the region's geological and economic resources. Progressing from the early documentary missions, more recent photographers viewed the now more developed and familiar landscape through a socio-political and environmentalist perspective. For example, the work of the contemporary photographer Richard Misrach (1949-) focuses on the effect of human exploitation on the landscape of the Interior Basin-and-Range and desert Southwest regions. Roger Minick (1944-) accepts humans in the landscape and as a part of the landscape and has a more positive and humorous approach in his work. While acknowledging the social content of Misrach's and other's work, this thesis will highlight the work's concurrent aesthetic qualities. In doing so, this paper recognizes the formalist considerations of landscape photography that are essential to understanding the allure of the American West as subject matter and as a treasure trove of "found art" for artistic vision.

<https://symposium.foragerone.com/2022-racas/presentations/45848>

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## **Defined power limits prevent cellular damage during longitudinal *in vivo* 3-photon imaging of mouse cortical gray and white matter**

Alexandra Ramirez, *Biomedical Sciences*

Mentor: Ethan Hughes

### **Abstract:**

*In vivo* 2-photon microscopy (2PM) allows for longitudinal tracking of individual cells over time; however, this method is limited to depths of ~400  $\mu\text{m}$  into the mouse cortex. The development of *in vivo* 3-photon microscopy (3PM) increases this depth limit to ~1200  $\mu\text{m}$ , which includes the subcortical white matter. Because 3PM requires high pulse energy, the potential for tissue damage is significantly higher than 2PM, and such effects are magnified with longitudinal imaging. In this study, we tracked individual oligodendrocytes over ~3 months with longitudinal 3PM imaging. Following the study, we used correlative post-hoc immunostaining of longitudinally imaged brain regions to assess multiple markers of cellular and molecular stress. We found that, within our empirically determined laser power limits, longitudinal *in vivo* 3PM imaging did not significantly increase the fluorescence intensities of markers of cellular reactivity in oligodendrocytes, microglia, astrocytes, or neurons when compared to contralateral controls. Then, we analyzed the intensity of molecular markers of oxidative stress and phototoxicity specifically in oligodendrocytes and similarly found no differences between imaged and contralateral cortical hemispheres. In contrast, we found increased markers of cellular reactivity, oxidative stress, and phototoxicity in tissues exposed to elevated laser power limits that resulted in laser-induced tissue damage. Our results broaden the understanding of region-specific differences in oligodendrogenesis and prove that longitudinal *in vivo* 3PM imaging over multiple months is sustainable without inducing laser damage and cellular stress. These experiments provide important imaging and analysis guidelines for future studies employing longitudinal 3PM imaging in the mouse brain.

<https://symposium.foragerone.com/2022-racas/presentations/45468>

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## **Detecting Malicious Social Bots On LinkedIn**

Mirakle Wright, *Tech, Engineering & Math*

Mentor: Haadi Jafarian

### **Abstract:**

Social media bots have become an increasingly popular tool to influence digital communities and interactions. Sybils are fake accounts used for a disproportionately large influence on social media that are run partially by humans with the goal of drawing out information from unsuspecting users. Literature reflects that average technology users are not always educated enough spotting these fake accounts and this makes them susceptible to having their information stolen. The purpose of my study is to analyze how different age groups and demographics determine what is and is not a fake account and how education or a lack thereof affects this. When implemented, my social media platform of choice will be LinkedIn, as this is not a traditional social media site in that it requires you to share a lot of personal information. I will create three to four fake accounts of varying degrees, some with small discrepancies and some with larger ones, and survey users on which accounts they think are fake, which ones are real and how they came to this conclusion. A training course will be created to educate the subjects on how to recognize fake accounts and then a second survey will be implemented. The second survey consists of three to four different accounts, fake to varying degrees in which the subjects will once again determine which ones are real and which ones are fake. This study has implications of how cybereducation can help protect users from malicious activities online.

<https://symposium.foragerone.com/2022-racas/presentations/45523>

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## **Determinants of tooth loss in adults at University of Colorado Anschutz Medical Campus dental clinics**

Nhi Nguyen, *Arts & Media*

Mentor: Rachel Johnson

### **Abstract:**

The loss of teeth can cause bacteria to collect under the gum line, resulting in more gum disease, bone loss, and shifting of adjacent teeth. Therefore, predoctoral dentistry students must understand population surveillance in order to provide adequate care to the population and promote the health of the population. The purpose of this study was to teach data analysis to dental students and to conduct a study on the correlation between systemic factors and the prevalence of dental caries in patients attending the dental clinics at the University of Colorado School of Dental Medicine. Students were trained on how to use the EHR data mining methodology and then collected data about factors associated with tooth loss from patients under the instructor's guidance. In Fall 2021, 1,180 patients visited the clinic; 242 (20.5%) of them had <20 teeth. In unadjusted logistic regression models, cardiovascular disease, diabetes, tobacco use, immunocompromised status, and pulmonary disease(s) were significant predictors of tooth loss. The results showed significantly higher odds of having <20 teeth for those who reported cardiovascular disease (OR=2.38, 95% CI 1.79, 3.18,  $p < 0.001$ ), diabetes (OR=1.47, 95% CI 1.03, 2.09,  $p = 0.032$ ), tobacco use (OR=1.68, 95% CI 1.15, 2.43,  $p = 0.007$ ), immunocompromised (OR=2.50, 95% CI 1.62, 3.82,  $p < 0.001$ ), and pulmonary (OR=1.51, 95% CI 1.03, 2.20,  $p = 0.032$ ). After adjusting for age, race, gender, insurance status, and the number of comorbidities, the odds of having 20 teeth for patients who use tobacco (OR=2.60, 95% CI: 1.69, 3.99,  $p < 0.001$ ) and those who are immunocompromised (OR = 1.86, 95% CI: 1.13, 3.05;  $p = 0.014$ ) were still significantly affiliated with tooth loss.

<https://symposium.foragerone.com/2022-racas/presentations/45417>

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## **DEVELOPMENT OF A KINETIC MODEL OF *ESCHERICHIA COLI* CODON TRANSLATION**

Jillyn Tittle, *Natural & Physical Sciences*

Mentor: John D. (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 noncognate 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 noncognate attempts for each of the 64 codons. Average insertion times ranged from 13-469 ms per amino acid, average error rates ranged from 0-164 for 10,000 amino acids, and near-cognate and noncognate 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/2022-racas/presentations/45524>

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## **Differences in Accuracy, Reaction Time, and Eye Movements During Search for Different Size Targets**

Christiana Smith, *Social Sciences & Humanities*

Mentor: Carly Leonard

### **Abstract:**

Throughout life, people are constantly moving their eyes, but deciding where to look is a complex process that requires perceptual processing of visual stimuli. The purpose of this study was to determine the target contour size and density to be used in a future EEG study that will measure individual differences in neural activity as it pertains to saccadic behavior and perceptual processing. For the purpose of this study, the goal was to find the target size and density that was not too hard or too easy. In this study, participants were required to do four different trials where each trial had a different distractor density. There were a total of eight participants and of the four trials, two trials included a large target contour size and two included a small target contour size. Participants were shown examples of each target contour size in order to be able to accurately recognize each target contour throughout the trials. Eye movements were tracked using an Eyelink eye tracker. Planned analyses will look at accuracy, reaction time, and eye movements amongst participants.

<https://symposium.foragerone.com/2022-racas/presentations/45543>

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## **Does the early bird actually get the worm? A review of time of day effects and individual differences on cognitive tasks**

Katelyn Stollsteimer, *Social Sciences & Humanities*

Mentor: Dr. Carly Leonard

### **Abstract:**

A wide variety of research has been done on how time of day affects performance in several fields of study, including sports, academics, and shift work. However, time of day effects can also be seen on a variety of cognitive and attentional tasks. Overall, differences are observed between morning and night chronotypes, which are what we typically define as “early birds” and “night owls.” This effect has been termed as the synchrony effect in which performance is better at optimal times of day and worse at nonoptimal times of day (Nowack & Van Der Meer, 2018). Several studies including those done by Nowack & Van Der Meer (2018) and Smit et al. (2019) have seen morning chronotypes as being effective at their cognitive and attentional tasks, regardless of time of day, whereas evening chronotypes show deficits during the morning testing sessions. However, there is some disagreement in the literature as a study by Ceglarek et al. (2021) showed evening types to be more efficient at their tasks, regardless of time of day. These findings may have implications for the time of day at which studies are conducted. This presentation will review the literature surrounding the synchrony effect, specifically the impact of time of day on performance on cognitive tasks. At the end I will propose a novel experiment to further the literature.

<https://symposium.foragerone.com/2022-racas/presentations/45532>

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## **Effect of Thermal Noise on Relaxation Oscillations in Superconducting Quantum Interference Devices**

Thomas Baker, *Natural & Physical Sciences*

Mentor: Martin Huber

### **Abstract:**

The superconducting quantum interference device (SQUID) is a magnetometer capable of quantum-limited measurements of magnetic flux. When fabricated on the tip of a nanopipette, the resulting SQUID-on-tip sensor can measure spatially distributed fields with a resolution on the order of nanometers. Electrical circuits containing



hysteretic SQUIDs such as these are subject to relaxation oscillations under certain operating conditions. These relaxation oscillations degrade the performance of the SQUID. The performance issues caused by relaxation oscillations can be mitigated using shunt resistors, but some circuit designs make it difficult to include effective shunt resistors. An understanding of relaxation oscillations is therefore necessary in order to properly design and operate these SQUID circuits. Many models exist for relaxation oscillations in SQUID circuits, but limited research has been published on the effect of intrinsic thermal noise on relaxation oscillations. For this project, I modified a published model for relaxation oscillations to include noise and wrote a computer program to numerically simulate this model. I then simulated relaxation oscillations both with and without thermal noise in order to determine the effect of this noise on the frequency and dc average of the relaxation oscillations. I found that thermal noise causes a spread in the frequency of the relaxation oscillations and, in some cases, an increase in the average frequency. I also observed a rounding at the corners of the graph of the dc average of the oscillations. This computer program will later be used to simulate relaxation oscillations in SQUIDs that are fabricated and tested in our laboratory.

<https://symposium.foragerone.com/2022-racas/presentations/45552>

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### **Effects of PFAS exposure on DNA repair and Cell-cycle Biomarkers**

Cason Haffner, *Natural & Physical Sciences*

Mentor: Alan Vadja

#### **Abstract:**

Polyfluorinated alkyl substances (PFAS) are a type of man-made persistent chemical that can biomagnify in the food-chain. It is used in fire-fighting foams, and in many water- and stain- resistant consumer goods, from nonstick pans to dental floss. Due to PFAS solubility, persistence, and widespread use, it has contaminated much of our drinking water. There are no federal regulations limiting the concentration of PFAS in drinking water. It is widely accepted that virtually everyone in the developed world has detectable levels of PFAS in their blood. PFAS have been linked to concerning health issues in humans, including cancer and decreased fertility. Testes cell-cycle analysis may provide a suitable indicator of human and ecological risk from exposure. Evaluating markers of cell proliferation and apoptosis in testes is indicative of the cells' ability to repair DNA under different levels of contaminant exposure.

<https://symposium.foragerone.com/2022-racas/presentations/45545>

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### **Effects of specialized pro-resolving lipid mediators on pollutant-exacerbated allergic airway inflammation**

Vincent Conrad, *Biomedical Sciences*

Mentor: Alison Bauer

#### **Abstract:**

Despite decades of asthma research and improved understanding of underlying causes, high burdens of asthma morbidity in urban communities continue. One postulated reason for this is higher pollution levels, of which polycyclic aromatic hydrocarbons (PAHs), such as benzo[*a*]pyrene (B[*a*]P), predominate. Numerous studies have demonstrated associations between PAHs and adverse respiratory outcomes; however, the underlying mechanisms are not yet understood. We have recently shown that PAHs and allergen result in the up-regulation of bioactive, pro-inflammatory lipids (e.g. prostaglandins and leukotrienes). This and other data suggest that bioactive lipids provide a mechanistic link between PAHs and asthma; however, this has not yet been tested. We hypothesize that an allergen (lipopolysaccharide, LPS), combined with B[*a*]P, stimulates pro-inflammatory mediators that reduce pro-resolving lipids in human bronchial epithelial cells, while specialized pro-resolving lipid mediator (SPM) intervention *in vitro* reverses the pro-inflammatory response and imbalance. BEAS2B cells (a human bronchial epithelial cell line) were treated *in vitro* with LPS and B[*a*]P for either 4, 8 or 24 hours. Our model used SPMs (14(S)-HDHA, 17(R)HDHA, 10(S),17(S)-DiHDHA) at the 24 hour time point as an intervention. Cytokine ELISAs (IL-6, IL-8) were done. COX-2 and cPLA<sub>2</sub> mRNA levels were determined via qRT-PCR. Lipidomics was done on some samples. Addition of LPS combined with B[*a*]P show higher levels of secreted pro-inflammatory cytokine expression compared to either treatment alone.

Treatment with SPMs show significant decreases in expression of these cytokines for cells treated with LPS and with the combination of LPS and B[a]P. COX-2 and cPLA<sub>2</sub> expression were altered with B[a]P and LPS treatment, and their levels were reduced with SPM intervention. Lipidomic data indicates that addition of LPS inhibited the secretion of 17(R)-HDHA. Results suggest SPMs as potential treatments for individuals with chronic airway diseases, however further research is needed to determine their mechanism(s) of action.

<https://symposium.foragerone.com/2022-racas/presentations/45494>

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### **Enabling Sleep Staging on Edge Devices**

Sarah Morgan, Muhammad Hussain, Timothy Frymire, *Tech, Engineering & Math*

Mentor: Farnoush Banaei-Kashani

#### **Abstract:**

With the prevalence of edge devices such as mobile and IoT devices, the need for intelligent processing of data collected by edge devices, is rapidly growing. On the other hand, due to their large size and considerable computational resource requirements, intelligent deep learning models that can process the data collected by the edge devices must often be hosted in the cloud or on remote servers, rather than the resource-constrained edge devices themselves. This will in turn incur excessive consumption of network bandwidth to communicate the data between edge devices and the models, in addition to latency in processing of the data as well as data privacy concerns. A desirable alternative is to process edge data directly on edge devices. This can be enabled by developing “edge models”, i.e., deep learning models that can maintain accuracy with significantly reduced resources requirements (small memory footprint, low energy consumption, and low CPU usage) to be hosted on resource-constrained edge devices.

In this project, we use the “knowledge distillation” technique to develop an accurate and efficient edge model that can perform sleep staging on a mobile device that receives EEG data from a proprietary sleep aid device (the Earable™ All-in-One Sleep Aid Device). Sleep staging refers to the classification of sleep into five standard sleep stages (Wake, N1, N2, N3, and REM), and is key to monitoring and diagnosis of sleep abnormalities. With knowledge distillation, we distill knowledge from an accurate but resource-hungry “teacher” model, namely, the Tiny Sleep Net, to a resource-efficient “student” model (the edge model) that can be hosted directly on the mobile device. We have deployed our edge model on a mobile device, and with extensive experiments, demonstrated that our edge model uses significantly less computational resources as compared to the teacher model, with some loss in accuracy.

<https://symposium.foragerone.com/2022-racas/presentations/45452>

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### **Estimating Genetic Predisposition to Disease in Summary Data Using Summix**

Nikole Scribner Trout, *Natural & Physical Sciences*

Mentor: Audrey Hendricks

#### **Abstract:**

Recently, genetic summary datasets, such as genome wide association studies (GWAS), have become broadly available online. Sufficiently powerful case-control studies to identify novel genetic variants are complex and expensive; therefore, making use of anonymized summary datasets in genetic research- for example, as common controls- has a high degree of utility. However, important characteristics of individuals are obscured when summarized, resulting in issues such as the inclusion of unidentified disease cases that limit the usefulness of summary data. Here we investigate whether Summix, a method for detecting and adjusting for ancestry in genetic summary data, may also be applied to estimate the proportion of genetic predisposition to a disease such as prostate cancer. We obtain risky variants for prostate cancer and reference allele frequencies in case and control populations

from existing polygenic risk models. We then apply Summix to estimate the genetic predisposition to disease within observed summary data. Tests are performed using gnomAD data from non-Finnish European ancestry as the observed summary population to minimize the impact of ancestry on the results. Among all males in the gnomAD dataset tested, we find 19.25% have a high genetic risk for prostate cancer, in line with lifetime incidence of prostate cancer in the US. Results are also consistent among population subsets of the gnomAD data. Further investigation and testing is warranted, but these results are promising, and the application of Summix to detect the proportion of genetic predisposition to conditions opens the door for its use to detect and adjust for many genetically mediated diseases improving the utility of summary data for use as common controls in genetic studies.

<https://symposium.foragerone.com/2022-racas/presentations/45548>

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### **Estrous cycle modulation of fear extinction and relapse: Role of a substantia nigra-to-dorsolateral striatum pathway**

Margaret Price, Alyssa Hohorst, *Natural & Physical Sciences*

Mentor: Dr. Greenwood

#### **Abstract:**

Estrous cycle modulation of fear extinction and relapse: Role of a substantia nigra-to-dorsolateral striatum pathway  
AA. Hohorst, ML. Price, MK. Tanner, BN. Greenwood

Impaired inhibition of learned fear is a feature of stress-related psychiatric disorders like depression, generalized anxiety disorder and post-traumatic stress disorder (PTSD). Extinction-based exposure therapy is an effective treatment strategy for these disorders but has limited long-term efficacy due to vulnerability of fear memories to relapse. Additionally, women are up to 60% more likely to experience anxiety disorders and up to twice as likely to experience PTSD compared to men, however, these sex differences are not fully considered in neuroscience. Prior data suggest learning fear extinction during estrous phases with high levels of ovarian hormones (proestrus and estrus, Pro/Est) enhances fear extinction memory and reduces relapse in females. However, how levels of fear relapse in females exposed to fear extinction during Pro/Est compares to males, and mechanisms underlying gonadal hormone-modulation of fear extinction and relapse, are unknown. Increasing dopamine (DA) signaling in the striatum enhances extinction memory, and females have higher stimulus-evoked striatal DA release than males and during Pro/Est. DA neurons originating in the substantia nigra (SN) and terminating in the dorsolateral striatum (DLS) contribute to stimulus-response (“habit”) learning, which can be resistant to memory-disrupting phenomena thought to contribute to relapse. This study aims to characterize effects of estrous phase and sex during fear extinction learning on later fear extinction recall and relapse, and to determine the role of the DASN-DLS circuit in mediating the effects of Pro/Est. Females exposed to fear extinction training during Pro/Est were protected from fear relapse compared to both males and females exposed to fear extinction during other estrous phases. Chemogenetic inhibition of the DASN-DLS circuit during fear extinction had no effect on fear extinction acquisition, but restored fear relapse in females that learned extinction during Pro/Est. These data suggest ovarian hormones interact with the DASN-DLS circuit to render fear extinction memory resistant to relapse

<https://symposium.foragerone.com/2022-racas/presentations/45502>

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### **Evaluation of lung progenitor cell growth in 3D hydrogels**

Jacqueline Miller, *Biomedical Sciences*

Mentor: Chelsea Magin and Alicia Tanneberger

#### **Abstract:**

Pulmonary epithelial cells, more specifically, alveolar type II (AT2) cells play a major role in lung physiology and function. These cells have been difficult to isolate and expand outside of the body. Therefore, researchers have begun to use induced pluripotent stem cells (iPSCs) as an alternative cell source to study lungs *ex-vivo*. iPSCs can be

differentiated by exposure to specific small molecules into AT2-like cells. The aim of this project was to investigate how changes in the cellular environment affects differentiation into AT2 cells within three-dimensional (3D) synthetic biomaterials. Poly (ethylene glycol) alpha methacrylate (PEG $\alpha$ MA), a type of phototunable synthetic hydrogel, was formulated to match the elastic modulus (stiffness) ranges observed in both healthy and fibrotic lung tissue. These synthetic hydrogels also contained a biodegradable matrix metalloproteinase (MMP) crosslinker sequence that could be targeted by the MMP enzymes secreted by the cells within. As lung cells mature, they shift from predominately secreting MMP-2 to MMP-3, and then MMP-9 enzymes. Therefore, the goal of this project was to determine whether lung progenitor (LP) cells derived from iPSCs grew better within 3D PEG $\alpha$ MA hydrogels containing an MMP-2, MMP-3-, or MMP-9-degradable crosslinker. Hydrogels were mechanically characterized using rheology to measure the elastic modulus. iPSCs were then flow sorted for NKX2.1, an LP marker, and embedded into the three types of PEG $\alpha$ MA hydrogels. After 14 days, endpoint imaging was done to compare cell sphere size, number, and quality grown in each formulation. Results indicated that the MMP-9-degradable crosslinker had the highest sphere numbers, size, and quality compared to MMP-2- and MMP-3-degradable crosslinkers (p-values

<https://symposium.foragerone.com/2022-racas/presentations/45444>

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### **Evaluation of Student Knowledge of Five Core Chemistry Concepts Student Knowledge After Two Years Later**

Kathleen Le, *Natural & Physical Sciences*

Mentor: Dr. Priscilla Burrow and Dr. Vanessa Fishback

#### **Abstract:**

DFW (drop, fail, withdrawal) rates in STEM courses are traditionally higher than in other disciplines. The purpose of this project, funded by the CLAS Act Grant, is to evaluate student knowledge of five core chemistry concepts in General Chemistry I, General Chemistry II, Organic Chemistry I, and Organic Chemistry II. These five core concepts are 1) physical and chemical properties, 2) stoichiometry and equations, 3) acid-base chemistry, 4) glassware and equipment and 5) written communication in chemistry. Three of the five core concepts are examined via a knowledge quiz. The basis of this project is to determine if knowledge of physical and chemical properties, stoichiometry, and acid-base chemistry are retained from their introduction in General Chemistry I through Organic Chemistry II. The content quiz provided information about mastery and retention of topics through the four-course sequence. The project also involved initial validation of the quiz questions via a survey of faculty and students.

The CLAS Act grant has been ongoing for three years. During the first year, videos were implemented and student data was collected. The original intention of the videos was to reinforce concepts necessary for success in this four-course sequence and subsequent chemistry courses through repetitive viewing. The second year involved continuation of collection of student data IRB approval, distribution of questionnaires to CU Denver Chemistry faculty to begin content quiz question validation, as well as initiation of student interviews. The third year has been primarily focused on processing and extracting useful information from the content knowledge quiz data that has been collected each semester since Fall 2019. The data will be used to understand an individual student's chemistry knowledge retention through the four-course sequence.

<https://symposium.foragerone.com/2022-racas/presentations/45478>

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### **Examining The Patterns of Associations Between Parent/Child Closeness and Child Behavior Problems in Army Families**

Brandon Choi, *Social Sciences & Humanities*

Mentor: Elizabeth Allen

#### **Abstract:**

The culture and demands of military life may affect child outcomes. The purpose of this study is to examine how certain aspects of military and family life may moderate the relationship between parent/child closeness and child

behavior problems for Army families. Using a sample of 366 families from the Army Marriage Project, identification with Army values (i.e., feeling that being an Army family is an important aspect of family identity, values, and expectations) and family living arrangements (i.e., living on or off base) were assessed as potential moderators of the association between parent/child closeness and child behavior problems. The analyses were conducted individually (SM and spouse separately) and in aggregate (averaged for SM and spouse). Lower parent/child closeness was related to greater child behavior problems when closeness was assessed in aggregate,  $r = -.361$ ,  $p$  <https://symposium.foragerone.com/2022-racas/presentations/45425>

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### **Exploring Floral Resources for Pollinators in Denver, Colorado**

Elizabeth Kuhn, Hillary Hillam, *Natural & Physical Sciences*

Mentor: Dr. Christy Briles

#### **Abstract:**

Urban development degrades and reduces natural resources available to pollinators. Honeybees (*Apis mellifera*) are an introduced species and polylectic (generalist), and can therefore determine floral resources for pollinators. The purpose of this study is to explore resource availability in urban and suburban environments of Denver, Colorado utilized by honeybees. Honey from six hives were sampled during September 2022 (three hives located in the Littleton area and three hives on Auraria campus). Samples were then processed chemically to isolate individual pollen grains, counted, and analyzed to determine abundance and amount of resource types available for bees. *Tilia* (linden), a tree that produces both nectar and pollen for bees, was the main resource utilized in both Denver and Littleton. This was followed by *Salix* (willow) and *Prunus* (fruit trees). This suggests that there are more resources available in the spring and early summer compared to later in the season, as they are all spring blooming species. This data is important to identify necessary resources used by honeybees, as well as the varied resources utilized throughout the season within urban and suburban landscapes. Future development within this region can benefit from understanding the current resources available and the potential for further improvement to support pollinator sustainability.

<https://symposium.foragerone.com/2022-racas/presentations/45479>

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### **FES Cycling - A Remote Control for Paralyzed Legs**

Adrienne Ellett, *Biomedical Sciences*

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 exercise 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). This project focuses 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 improved long term health outcomes.

This project will seek to improve the field of wearable FES devices for cycling. 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. The data is processed using an algorithm that detects when each leg reaches certain points in the cycle. Our algorithm then decides which target muscles should receive an electrical pulse to contract the muscles. A user interface was developed to allow for user modifications in the strength and duration of the electrical signals. This interface shows anatomical and written representations of the

muscles being stimulated, the raw acceleration data, and the settings that can be modified for each patient. Future work on this design will include the integration of an electrical amplifier capable of delivering an electrical pulse strong enough to contract the muscles. This will complete the prototype and allow it to be used in a clinical setting to test its feasibility and efficacy as a therapy device.

<https://symposium.foragerone.com/2022-racas/presentations/45354>

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### **Fine Particulate Matter (PM2.5) as a Major Health Risk in Cities Around the World**

Hunter Carroll, *Tech, Engineering & Math*

Mentor: Priyanka deSouza

#### **Abstract:**

Fine particulate matter (PM2.5: mass concentration of particles having a diameter of  $< 2.5 \mu\text{m}$ ) is a major environmental health risk in cities around the world. There is overwhelming evidence that there are significant racial inequalities in exposure to pollution (Tessum et al., 2021; Bell et al., 2002). Nearly all of this research has focused exclusively on exposures in the place of residence and not on work. Yet, occupational health researchers have long shown racial disparities in health risks at specific sites of employment. There is an urgent need to build on this prior literature to examine if disparities in exposure to pollution exist across a range of workplaces in the US, and to examine how they compare with disparities in places of residence. Elliott and Smiley (2019) have examined such disparities in exposure in work census tracts of employed residents in Houston, Texas. However, no research examines disparities in work census blocks of employed adults in the national US. No research has examined how such disparities differ by type of job (low-wage, medium-wage and high-wage). Finally, there is little research that examines how modes of commuting available to individuals create and uphold such workplace disparities in exposure to pollution. This research attempts to fill in the gap using data by creatively combining different publicly available datasets.

<https://symposium.foragerone.com/2022-racas/presentations/45507>

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### **FinTech & Positive Social Impact: Jamaica Meets Bly**

La-Doniea Nisbeth, *Tech, Engineering & Math*

Mentor: Esther Sullivan

#### **Abstract:**

After research and gaining the understanding that there is a link between positive social impact and financial technology, I used these observations to get closer to the goal of establishing a FinTech app in Jamaica. FinTech innovation is happening at a rapid pace and there are currently multiple ways to pay for goods and services. FinTech is short for financial technology, and financial technology seeks to improve the delivery and use of financial services. FinTech has transformed many economies through establishing convenience and unprovoked access for underrepresented populations in industries they care about most. These industries include education, payroll, and personal finance. This Spring, I focused on team building, regulatory review, user testing, and creating a design guide. These would all help with making the first and simplest version of the FinTech app. The results included:

- Finding a name for the app (Bly:to give a chance).
- Challenge faced in our efforts was reaching Jamaicans in Jamaican to gain relevant insight through surveys, app testing and interviews to make the application meet their needs.
- We pitched in the CLIMB competition Fall & Spring. Semi-finalist with the main review being partnering with an existing institution to make implementation easier. Also, questions on regulations.
- The legal ramifications of FinTech in the Caribbean aren't as clear currently because it's new there.
- MVP (Minimum Viable Product) screens for first version of app.

<https://symposium.foragerone.com/2022-racas/presentations/45522>



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## **Food Rewards and Risks Experienced by Ravens and Magpies Interacting With Captive Wolves**

Summer Richman, *Natural & Physical Sciences*

Mentor: Dr. Diana Tomback

### **Abstract:**

Common ravens (*Corvus corax*) and black-billed magpies (*Pica hudsonia*), avian Family Corvidae, show up reliably at gray wolf (*Canis lupus*) kills in Yellowstone National Park and in other regions in North America (Walker et al. 2018; Smith 2013). At these kills, they usually obtain some food. These birds (corvids) also are visitors to captive wolves in wildlife sanctuaries (Tomback, unpub.). In the wild and in wolf sanctuaries, ravens and magpies sometimes risk their lives in interactions with wolves over food (Photo 1).

Although the relationships between ravens and magpies and wolves are being studied in Yellowstone National Park, no studies have been conducted with captive wolves to determine if the birds are rewarded for their risk.

We are studying the interactions between magpies, ravens and 13 captive wolves at the Colorado Wolf and Wildlife Center, Divide, CO, before and during feeding time to determine the reason why corvids visit wolves. Our overarching questions are whether corvids receive food rewards routinely, which might explain the time they spend with wolves and what level of risk they face in the process.

We are observing wolf and bird interactions in 7 enclosures before, during, and after feeding time. The specific objectives of our study are to determine: (1) What proportion of ravens and magpies on a given date or across our study receive a food reward? (2) How do wolves behave towards ravens and magpies in their enclosures with food present? (3) Are any birds killed or injured during these interactions in enclosures?

<https://symposium.foragerone.com/2022-racas/presentations/45659>

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## **Free Trade and The Great Exhibition of 1851**

Kristine Kohlmeier, *Social Sciences & Humanities*

Mentor: Marjorie Levine-Clark

### **Abstract:**

Visitors to London in May through October 1851 most likely would have found themselves greeted by a bustling city swelled to nearly three times its regular size. A new building aptly named the Crystal Palace located in Hyde Park housed over 13,000 exhibits ranging from priceless art to room-sized machinery. Known colloquially as the Great Exhibition and formally as the Great Exhibition of the Works of Industry of All Nations, it would become the first in a long line of world's fairs. The Great Exhibition stood in contrast to many of the exhibitions that preceded it. Exhibitors were accepted from all over the world and from a multitude of commercial sectors. It offered Victorians of every class and overseas visitors a look into a world not usually open to them. Machinery and finished goods from across Europe and raw goods from a number of British colonies were all showcased in one place celebrating modern economic success.

The road to the Great Exhibition was not a predetermined one. Only a few years before in 1845, a Great Exhibition of British goods failed before an "indifferent" public and "lukewarm" businessmen. The Great Exhibition of 1851 was differentiated by the international competition opened up by the repeal of the Corn Laws in 1846 and the Navigation Act of 1849, which introduced free global markets. These laws were ushered in by voting reform, which took place in 1832, expanding the vote to Victorian middle-class men. In this way, the Great Exhibition was mobilized by the growing agency of the middle class in British political and economic life. The Great Exhibition was a culmination of change, opening its doors to the corners of the globe unlike its stunted and largely forgotten protectionist counterpart.

<https://symposium.foragerone.com/2022-racas/presentations/45476>

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## **From Grandeur to Indecency: The Evolution of the Syrian Baath Party through the Eyes of Filmmaker Omar Amiralay**

Khalid Mhareb, *Social Sciences & Humanities*

Mentor: Dale Stahl

### **Abstract:**

When the Syrian Baath Party took over the country in 1963, many Syrians like filmmaker Omar Amiralay felt a sense of hope. In his directorial debut, “A Film Essay on the Euphrates Dam” (1970), Amiralay saw the new government’s building of the al-Tabqa Dam on the Euphrates River as one of the Arab World’s greatest achievements. The huge, complex structure offered evidence that a new era of modernity was on its way. However, the facade of progress soon wore off, and Amiralay began to see the Baath for what they were: dictatorial and phony. In his next set of films about Syrian society, “Everyday Life in a Syrian Village” (1974) and “A Flood in Baath Country” (2003), Amiralay’s disillusionment became apparent. In these two documentary-style films, the director highlighted the ironies and hypocrisies of the Baath Party. This research will follow the career of Omar Amiralay and consider his Euphrates trilogy of films, showcasing the descent of the Baath Party from its hopeful beginnings.

<https://symposium.foragerone.com/2022-racas/presentations/45483>

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## **Galactic Rotation Curves as Evidence for Dark Matter**

Kathryn Harris, Judit Bergfalk, Francis Vititoe, Julia Johnston, *Natural & Physical Sciences*

Mentor: Anthony Villano

### **Abstract:**

Dark matter is estimated to make up ~60% of all normal/baryonic matter but cannot be directly imaged. Despite the fact that dark matter cannot be directly observed yet, its influence on the motion of stars and gas in spiral galaxies has been detected. One way to show motion in galaxies is to produce rotation curves that are plots of velocity measurements of how fast stars and gas move in a galaxy around the center of mass. According to Newton's Law of Gravitation, the rotational velocity is an indication of the amount of visible and non-visible mass in the galaxy. Given that the visible matter can be estimated using photometry, dark matter mass in galaxies can be calculated. In order to gain a greater appreciation of the research scientists' findings about dark matter, their method should be easily reproduced by any curious individual. Our interactive workshop is an excellent educational tool to investigate how dark matter impacts the rotation of visible matter by providing a guide to produce galactic rotation curves. The Python-based notebooks are set up to walk you through the steps of producing rotation curves and to allow you to learn about each component of the galaxy. The three steps of the rotation curve building process is plotting the measured velocity data, constructing the rotation curves for each component, and fitting the total velocity to the measured values. After completing all the modules of the workshop, reading and understanding scientific journals of dark matter findings should be considerably easier.

<https://symposium.foragerone.com/2022-racas/presentations/45534>

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## **Gender Differences in Emotional Reactivity**

Danna Ramos, *Social Sciences & Humanities*

Mentor: Dr. David Albeck

### **Abstract:**

**INTRO:** There are multiple factors that can influence emotional reactivity, including gender differences.

**SPECIFIC AIMS:** The purpose of this study was to replicate Palmer’s finding that there are two clusters of scores on the Autism Spectrum Quotient survey (AQ); Cluster 1 = greater social difficulties and weaker detail orientation,

Cluster 2 = fewer social difficulties and high detail orientation (Palmer et al., 2014), and to answer whether there is a significant difference between gender and the participant's valence rating (positive, negative, and neutral) and arousal rating (emotional intensity) of images that include humans from the International Affective Picture System (IAPS) using the Self-Assessment Manikin's Survey. We hypothesized that women would report a higher average arousal to images that include humans.

**METHODS:** Participants were recruited through CU Denver's SONA system who received class credit for participation. The survey was also posted through Amazon's Mechanical Turk program and these participants received \$7.25/hour. We used Ward's method on SPSS to confirm Palmer's two clusters.

**RESULTS:** In our chi-square calculation, we found more males in cluster 1 and more females in cluster 2 ( $X^2 = 20.488$ ,  $p < .001$ ).  
**CONCLUSION:** We did not find that women reported higher arousal scores to images including humans, instead we found that males reported significantly higher average arousal and valence scores toward pictures with humans.

<https://symposium.foragerone.com/2022-racas/presentations/45457>

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### **Gender Diversity and Inclusivity in Nursing**

Amanda Taylor, *Social Sciences & Humanities*

Mentor: Dr. Joan Bihun

#### **Abstract:**

With the era of Florence Nightingale followed by World War II several decades later, nursing became a feminized profession. Because of their nurturing tendencies and the need for men in combat during war, women took over nursing roles. Since then, the nursing profession has remained female-dominated. The U.S. Bureau of Labor Statistics reported that in 2022, men comprise just 13.3% of the United States' nursing workforce. While an increase from 50 years ago, the integration of men into the profession has been a slow one. When entering a female-dominated profession, men must navigate the lack of male role models, isolation, gender role strain, and disapproval from family, friends, and society. Because of this, men tend to gravitate towards specialties that they feel more welcome in or pressured into, such as mental health, anesthesia, or critical care. This can create an even further divide. Times are rapidly changing when it comes to gender inclusivity in the workplace, but nursing is a profession that is still behind. To gain more insight, I designed a survey that was sent to pre-nursing students, nursing students, and current nurses. The data was used to collect information on the challenges participants experience, perceptions they hold, professional goals they have set, and reasons they have pursued a nursing career. The results are intended to identify the most prevalent challenges experienced and shed light on strategies to increase the number of men that are recruited and retained in the field of nursing. This will ideally help to create a more diverse workforce that is better able to serve the diverse patient population that it cares for.

<https://symposium.foragerone.com/2022-racas/presentations/45375>

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### **Growth of the Underrepresented: Spatial Data of the Lesbian Feminist movement of the 1970s and 1980s**

Ivy Martinez, *Social Sciences & Humanities*

Mentor: Professor Cameron Blevins

#### **Abstract:**

This project examines the history of the lesbian feminist movement of the 1970s and 1980s. During a time when many in this group were ostracized by much of society, they turned to magazines and other publications to create connections. The goal is to create a map using spatial data from these lesbian feminist publication sources to identify where and how these connections happened. The spatial patterns recreated by the data will supply a visualization of connections that helped tie this community together and help guide researchers to a better understanding of how those connections shifted over the 1970s and 1980s. The larger humanistic approach to this project is to uncover the story of marginalized voices and communities long underrepresented by most historical accounts.

<https://symposium.foragerone.com/2022-racas/presentations/45549>

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### **Gut Microbiome and Osteoarthritis in the Knee**

Xaverine Celia Moneboulou Mbazoa, *Biomedical Sciences*

Mentor: David A Villani

#### **Abstract:**

32.5 million Americans have Osteoarthritis. 66% of those diagnosed with OA were obese or overweight. Obesity apply pressure on the joints and increases the inflammatory pathways secretion. We hypothesize that by targeting the inflammatory pathways in the gut, one may reduce the progression of OA.

<https://symposium.foragerone.com/2022-racas/presentations/45674>

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### **Hanfu Resurgence in Modern Society**

Ashley Ng, *Arts & Media*

Mentor: Yang Wang

#### **Abstract:**

This semester, I am helping Professor Yang Wang in her research on neo-traditionalism in twentieth-century ink painting, with particular focus on how regional ink painting visualized Chinese nationalism in the early Maoist period. The themes of nationalism and national identity through visual culture overlap with my personal research on *hanfu*, a traditional form of Chinese clothing that dates back as early as the Shang dynasty (c. 1600 – c. 1046 BCE). Even though westerners often consider qipao as the most iconic form of “Chinese” clothing, hanfu is seen in China as a more authentic form of historical clothing” (Wang). In recent years, there has been a resurgence of *hanfu* in modern Chinese fashion. The movement has been promoting traditional hanfu back into regular, everyday wear through their incorporation of modern styles and makeup. According to scholar Kevin Carrico, the romanticization of ancient Chinese culture through hanfu in contemporary China reveals an aspect of modern-day Chinese nationalism. As an artist, I have been inspired by these recent trends and by my research to create a hanfu skirt for the upcoming CU Denver AAPI gala. Decoupling my interest from Chinese nationalism and honoring instead my heritage as a Chinese American, I want to incorporate traditional hanfu styles, mostly from the Ming dynasty, and art inspired by traditional ink art to create a modern look that represents my culture and is on trend with contemporary styles. . Fashion is changing constantly with the normalization of fast fashion, but most of the styles center on western style clothing. Through normalizing clothing from other countries and histories, we can further our society’s understanding of different cultures.

<https://symposium.foragerone.com/2022-racas/presentations/45550>

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### **Have a Nice Day**

Trey Daub, Ethan Lien, *Arts & Media*

Mentor: Eric Jewett and Jessica McGaugh

#### **Abstract:**

*Have a Nice Day* is a short narrative film that humorously chronicles the tedium of the day in the life of a liquor store clerk. However, on this particular day, the world will likely end. Everyone has felt at one point or another in the last two years a sense of looming dread living in a world dominated by the COVID-19 pandemic. Through *Have a Nice Day*, we encourage our audience to reflect upon their experiences facing crisis, take a much-needed moment to laugh at the absurdity of it all, and examine their own set of priorities in their professional lives. To achieve this, our film takes a microscopic approach to a macroscopic issue. An unprecedented asteroid is hurtling toward Earth with an 80%

likelihood to make impact, but instead of portraying the heroic, last-ditch effort undoubtedly being made by NASA, we focus on the mom-and-pop liquor store that cannot afford to close on the off chance the asteroid misses. The comedy of the film lies in the absurd notion that one would continue working through the apocalypse, but the drama of the film lies in the direct reflection of the millions who laced up their boots every day and did work through the height of the pandemic. Through this juxtaposition, we ask: at the end of the day, what is it that really matters?  
<https://symposium.foragerone.com/2022-racas/presentations/45366>

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### **High confidence computational analysis of single nucleotide variation consequences in homology models**

Jill Hoffman, *Biomedical Sciences*

Mentor: Scott Reed

#### **Abstract:**

Homology modeling is an efficient way to produce many protein structures without the time-consuming methods experimentally determined structures require. Recent advancements in homology modeling by using artificial intelligence programs such as AlphaFold2 developed by the DeepMind company have allowed for efficient prediction of protein structures and the consequences due to single nucleotide variations (SNVs). By using both homology and experimental structures, significant consequences to 3D structure that could result in disease can be analyzed.

Using high confidence predicted native protein structures from AlphaFold2, all possible mutated structure can be accurately produced using the FASPR software, which predicts protein side chain conformations. Python code can then be used to analyze different aspects of the native proteins and their mutants using either the experimentally determined or the predicted AlphaFold2 structure.

The analysis focuses on factors that would cause a significant alteration to the proteins 3D structure that due to the SNVs. This includes identifying if a cis proline is added or replaced and the effects of buried residues, such as proline, glycine, and charged residues, in relation to the surface of the protein. Future steps will be in adding deeper analysis of the buried residues to identify different bond breakages and additions.

The analysis can also be customized to fit the users need by excluding low confident structures and allowing a choice between the model used. The information obtained from this software will allow for quick high confident analysis for 23,000 native and mutant homology models or experimentally obtained models.

<https://symposium.foragerone.com/2022-racas/presentations/45395>

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### **HOW REFERENCE SAMPLE SIZES AFFECT SUMMIX'S PERFORMANCE**

Souha Tifour, *Biomedical Sciences*

Mentor: Audrey Hendricks

#### **Abstract:**

Individuals and samples from populations, such as African Americans and Latinx, lack precise matched ancestry data in publicly available summary genetic data. Researchers use the closest, but not accurately matched ancestral group for these populations. This leads to biased results in genetic studies. To address this problem, Summix was created to identify, estimate, and adjust for the proportion of continental reference ancestry in summary genetic data. The original evaluation of Summix uses reference data from five ancestry groups (African (AFR), Non-Finnish European (EUR), East Asian (EAS), Indigenous American (IAM), and South Asian (SAS)) to obtain estimates of continental ancestry within summary data. The reference sample size is an important consideration as small samples may decrease the accuracy and precision of the estimates. Hence, I use simulations to examine how the size of the reference groups affects the accuracy and precision of Summix's ancestry proportion estimates. Here,

1,000 replicates were used for each simulation scenario. For each simulation replicate, 10,000 genetic variants were randomly sampled. Ancestry proportions for the target population were chosen to approximate an African American population with an assigned ancestry proportions of: AFR= 0.80, EUR= 0.20, EAS= 0, IAM= 0, SAS=0. Then, simulation scenarios were performed for different reference sample sizes N = 10, 50, 100, and 500 and a target sample size of 10,000. The results indicate that Summix's accuracy and precision decreased as the reference sample size decreased. Interestingly, the decrease in both accuracy and precision appeared to be related to the inverse of the square root of the reference sample size. In summary, Summix estimates the ancestry proportions more accurately and precisely with larger reference sample sizes. This may enable us to update Summix's method in the future to make it more accurate and precise for smaller size reference populations.

<https://symposium.foragerone.com/2022-racas/presentations/45555>

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### **Identification of 1,4-Dioxane Degrading Microbial Communities from a Bioremediation Site**

Mindy Kennedy, *Natural & Physical Sciences*

Mentor: Timberley Roane and Chris Miller

#### **Abstract:**

1,4-dioxane has been classified by the Environmental Protection Agency (EPA) as a probable carcinogen, with the effects of exposure ranging from nausea and irritation to cancerous tumors and teratogenic effects in developing fetuses depending on the length of exposure. 1,4-dioxane has been used in the production of pharmaceuticals, degreasers, paint thinners, pesticides, PET plastic, metalworking, dyes, and cosmetics<sup>1</sup>.

Traces of 1,4-dioxane have been detected in aquifers underneath the once active Lowry Landfill site from waste that seeped through the unlined landfill into the ground beneath it. The landfill has since shut down operations and has been declared a Superfund site by the EPA in 1984 to enact decontamination through bioremediation of the contaminated groundwater to have no associated health risks with contact<sup>2</sup>. The bioremediation and degradation of 1,4-dioxane in the groundwater is completed by communities of microorganisms from the aquifers. The bioremediation is effective by the EPA's standards, however, there is no knowledge of how many organisms are living in these communities and what conditions support their growth.

Preliminary experiments with culturing these communities supported the hypothesis that multiple organisms are living at the site and revealed that some of these microorganisms can grow at 26°C without light in nutrient broth (NB), a defined mineral salts medium (DMSM), and nutrient agar (NA). Future work will involve further analysis of the samples to determine the microorganisms involved, how they are degrading the dioxane, and what can be done to supplement their depleting resources.

<https://symposium.foragerone.com/2022-racas/presentations/45363>

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### **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 (500-2000 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/2022-racas/presentations/45429>

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### **Impact of Wildfire particles on Mast cell activation**

Joey Vigil, *Biomedical Sciences*

Mentor: Dr. Jared Brown

#### **Abstract:**

The health impacts of wildfire smoke have risen over recent years. Here in Colorado in 2020, there were 935 square miles of land that were destroyed by wildfires. The increase in wildfires within Colorado and the Western regions of the United States have led to increase in wildfire smoke exposure in many communities. It has been recognized that inhalation of wildfire smoke leads to increases in pulmonary and cardiovascular complications. To further understand health impacts of wildfire smoke, I have been exploring the impact of wood smoke particles on mast cell activation. Mast cells are an innate immune cell that are found in high abundance in organs that interface with the external environment such as the lung, skin and gastrointestinal tract where they play a prominent role in allergic inflammation. Wood smoke particles were obtained from burning of pine wood in a kiln and extracted through a filter and resuspended in water. To examine cytotoxicity and mast cell activation, I exposed human mast cells to wood smoke particles ranging in concentration from 1-500 PPM. Cytotoxicity was measured using the Methyl Tetrazolium Salt (MTS) assay and mast cell degranulation was measured by examining release of b-hexosaminidase. We did not observe any cell cytotoxicity following exposure to wood smoke particles out to 24 hrs. However, wood smoke particles did cause degranulation of mast cells. These results suggest wood smoke particles may cause an allergic immune reaction via mast cell activation which could contribute to the reported adverse pulmonary effects in individuals exposed to wildfire smoke.

<https://symposium.foragerone.com/2022-racas/presentations/44492>

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### **Increasing Target Selectivity in the Promiscuous Neomycin B Aptamer via Sequence Modification with 8-Oxo-7,8-dihydroguanine (8-OxoG)**

Shawn Schowe, *Natural & Physical Sciences*

Mentor: Marino Resendiz

#### **Abstract:**

Aptamers are short sequences (oligonucleotides) of RNA or DNA that are designed to selectively detect and grab onto (bind) a particular target tightly (high affinity). Aptamers have a very similar function to protein antibodies however, they possess several advantages including thermal stability, decreased production cost, and decreased immunogenicity<sup>1</sup>. Over the last 20 years, research on aptamers has increased to further explore their potential as therapeutics, biosensors, and as industrial and agricultural tools. The key to an aptamer's success is its ability to discern between targets; promiscuous aptamers with little discretion could cause deleterious effects if used in any of the above avenues. For these reasons, aptamers possessing a predilection to one target out of a family of similar

compounds is vital to society, industry, and the scientific communities at large. Herein we investigated an RNA aptamer, published in 1995, designed to bind neomycin B, an aminoglycoside antibiotic (AgA), with a  $K_d$  200 nM. However, we found this aptamer has little selectivity and binds with nM affinities towards other AgAs. To this end, we made modified aptamers using with 8-OxoG and tested them with a library of AgAs. To create a more selective aptamer. It was determined that one of the sequences possessed a significantly increased selectivity towards neomycin B, with no loss in  $K_d$ . Finally, to make the aptamers resistant to RNase degradation, organic chemistry was used to develop and implement a new synthesis for of the 8-OxoG-2'-OMe phosphoramidite.

<https://symposium.foragerone.com/2022-racas/presentations/45351>

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## **Indigenous Peoples and "Disabilities": Alternative Health Care Legislation, Political Models, and ways of seeing bodies**

Aurelia Guerue, *Social Sciences & Humanities*

Mentor: Dr. Donna Langston-Martinez

### **Abstract:**

The application of Indigenous ontologies and epistemologies regarding “disability” in legislation and the political realm can provide alternative methods and social programs to care for “disabled” peoples. Wilma Mankiller transformed Cherokee ontology and epistemology into legislation, a political model and social programs for “disabled” tribal members. Mankiller’s political approach provides an alternative Indigenous model of health care that can be utilized by other Tribal Nations or local state governments in the United States to address the crucial need for care for “disabled” Native Americans and other “disabled” people. Indigenous epistemologies and ontologies pertaining to “disability” offer alternative ways to think of “disabilities,” bodies, and difference and thus alternative methods of care and seeing are produced which can provide better care not only for “disabled” Native Americans but all “disabled” people. This research illuminates how Indigenous epistemologies and ontologies regarding “disability” are starkly different from European paradigms which view the “disabled” as, “deviant,” “biological freaky,” “abnormal,” and “other.” Most Indigenous epistemologies and ontologies do not have a translation for “disabled,” and Indigenous societies valued ethnics of reciprocity, the science of interdependence and had different notions of difference which did not politically or socially stigmatize or devalue “disabled” bodies. The exploration of the relationship between Indigenous peoples and “disabilities” also reveals connections between the history of settler colonialism, citizenship, political power, and the binaries surrounding “disability.” Such binaries render the body hyper-visible and simultaneously invisible which inherently effect which modes of political power and protest that are available to “disabled” peoples. Wilma Mankiller was diagnosed with various medical conditions and her lived experience and political work also reveal alternative Cherokee ways of viewing “disabled” bodies through Cherokee ontology through a science of interdependence and ethnics of reciprocity which she translated through her political model and personal political activism. An Indigenous model of health care that centers a different notion of difference, care for other humans and does not view “disability” as a biological fact can provide foundations for future legislation and scholarship for “disabilities.”

<https://symposium.foragerone.com/2022-racas/presentations/45563>

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## **Indigenous Taiwanese Tattoo Traditions: Paiwan**

Alison Chen, *Arts & Media*

Mentor: Jeffrey Schrader

### **Abstract:**

Historically, the country of Taiwan has long been overshadowed by its western Pacific Ocean neighbors, China and Japan. Taiwan has also been subject to Dutch and Spanish colonial interests, given its enviable geographical location. Despite centuries of rule under the Qing Dynasty and decades of occupation by European forces, the

Indigenous people have carefully preserved their customs and ethnic traditions from these outside influences. Today, Taiwan is home to a rich diversity of Indigenous culture and landscape. Challenges, however, beset the disappearing art of traditional Indigenous tattooing.

The Paiwan tribe offers a prominent example. First regulated then banned by Japanese colonization during the late nineteenth to early twentieth centuries the customary tattoo culture of the Paiwan has sharply declined since. The importance of approaching this topic thoroughly through a combination of retrospective, sociopolitical, and prospective lens emphasizes the inseparable relationship between tattoos and native culture. Following the trajectory of Paiwan history is essential to understanding the techniques and materiality— as well as social and spiritual associations— found in their respective tattoo practices. It allows us to grasp the lasting effects of colonization, while simultaneously recognizing the slow, but promising revival of Paiwan culture and tattooing in modern times.

<https://symposium.foragerone.com/2022-racas/presentations/44383>

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### **Initial Development of a $^3\text{He}$ Neutron Flux Detector for SuperCDMS**

Alya Sharbaugh, *Natural & Physical Sciences*

Mentor: Dr. Anthony Villano

#### **Abstract:**

One of the greatest challenges facing the dark matter community is the presence of a low-energy neutron-induced background. This background makes it difficult to distinguish the similar signals which could indicate dark matter detection. By developing a cryogenic liquid Helium-3 detector, we hope to reliably measure the neutron flux near the Super Cryogenic Dark Matter Search (SuperCDMS) cryostat and be able to model the background with greater efficiency. This poster includes preliminary research and current computational models for the neutron response rate of Helium-3.

<https://symposium.foragerone.com/2022-racas/presentations/45472>

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### **Ink My Scars: Psychological and Medical Benefits of Tattoo**

April Andreasen, *Arts & Media*

Mentor: Yang Wang

#### **Abstract:**

Although the practice of tattoo has been documented since the fourth millennium BCE, art historians have only recently begun to study tattoo as a form of art and recognize its socio-cultural significance. Despite the inclusion of tattoo in art historical examination, the therapeutic qualities of tattoo have only received cursory mention in scholarly publications. My project builds on existing research on the artistic qualities of tattoo but will focus on the therapeutic, psychological, and medical benefits of tattoo. First, I will examine tattoo as a form of therapy for traumas such as PTSD, grief, self-harm, and suicide survival and/or prevention. I will then examine how tattoo enables self-expression and identity-formation, such as how it help individuals feel more connected to their ancestral and ethnic origins. Last, I will explore the medical benefits of tattoo as reconstructive treatment for burn victims, breast cancer survivors, and sufferers of skin disorders. I argue that tattoo distinguishes itself as an art form that possesses value beyond aesthetics and ornamentation. Etched on the body, the tattooed image leverages its permanence and location-specificity to provide therapeutic benefits to its owners. This thesis examines aspects of contemporary tattoo beyond their ornamental qualities to broaden not just “what” we consider art, but “how” we consider art’s place in society.

<https://symposium.foragerone.com/2022-racas/presentations/45847>

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## **Interactive Sound Design Education with VCV Rack**

Eli Kokesh, *Arts & Media*

Mentor: Cecilia Wu

### **Abstract:**

In the modern digital world, many seek technical education through online sources, especially in the field of digital music. However, this format usually cannot provide hands-on experience due to the limitations of the medium. This presentation showcases a portfolio of modular patches created with the open-source Eurorack [popular modular format] emulation software, VCV Rack 2.0. The intention of the designed patches is to create an informative and interactive learning environment such that students in the UCD arts program (and potentially anyone with access) can develop a better understanding of fundamental modular sound design concepts by learning via these patches. Along with general research about the subject matter, another area of focus was on the techniques used in the educational process. The goal was to find the area that could be improved on and build those into the patches. More specifically this involved building in a hands-on interactive aspect to sound design education and pairing that along with the more traditional conceptual lecture-based approach to education, both in the classroom and in online areas. The achievements of this project could be shown as an example of how to reframe education to be more effective, specifically in technical fields where hands on experience is necessary alongside traditional conceptual learning.

<https://symposium.foragerone.com/2022-racas/presentations/45474>

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## **Investigating Antiviral Response of HSV-1 infection in the Olfactory Epithelium**

Sandy Vang, *Biomedical Sciences*

Mentor: Dr. Laetitia Merle, Dr. Diego Restrepo

### **Abstract:**

The COVID-19 pandemic has shed light on post-viral loss of smell, but the antiviral response of the olfactory epithelium (OE) during viral infection remains unclear. The OE is located in the nasal cavity and is constantly exposed to airborne pathogens. Additionally, it is not known how the OE and cells within this unit contain viral infection and limit viral spread to the brain. One pathogen of interest is herpes simplex virus-1 (HSV-1). HSV-1 is a common and lifelong virus that is contracted either orally or intranasally. HSV-1 can travel along the trigeminal cranial nerves and establishes latency within the trigeminal ganglion. Upon reactivation events, HSV-1 can induce pathological changes in the brain that are hypothesized to promote Alzheimer's disease (AD). Olfactory dysfunction is a common and early symptom of AD, but whether HSV-1 promotes AD-related olfactory deficits remains debatable. We investigated how the OE induces an antiviral response in the presence of HSV-1 ( $10^6$  pfu per animal, McKrae strain) in 7, 24, and 72 hours post-infection in C57BL/6 male and female mice. We characterized the infection pattern across the nasal cavity. Surprisingly, we found few infection spots. The infection spots were located in the respiratory and olfactory epithelium, as well as in Steno's gland. Infected areas were associated with tissue degeneration and macrophages infiltration. HSV-1 was also rarely found in the olfactory bulb (OB). We hypothesize that rapid OE degeneration prevents HSV-1 from entering the brain through the OB. However, the tissue degeneration in the respiratory and olfactory epithelium might give HSV-1 access to trigeminal fibers endings, allowing the viral spread to the trigeminal ganglion. Our data indicate OE viral response protects the central nervous system from infection.

<https://symposium.foragerone.com/2022-racas/presentations/45564>

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## **Investigating the Genomics of Mountain Plover (*Charadrius montanus*)**

Zoe Erkenbeck, *Natural & Physical Sciences*

Mentor: Dr Mike Wunder

### **Abstract:**

The mountain plover (*Charadrius montanus*) is a species of special concern in Colorado and the state may encompass over half of the breeding population. However, little sequencing has been performed on the species and we have a poor understanding of the species genomics, it's relationship with other plover species and possible variation between breeding populations within the species.

Within *Charadrius* plover species chromosomal structure seems to be highly conserved so by full genome sequencing of the mountain plover and alignment to the chromosome level assembly of the European golden plover (*Pluvialis apricaria*) I investigated the chromosomal structure of Mountain Plover.

I am using alignments of mitochondrial sequences for 14 available Charadriiformes plovers to the mitochondrial contigs for mountain plover and to compare to previously published phylogenies to investigate and suggest the relationships between species. In addition to comparative genomics between species, ongoing work is investigating possible variation of breeding populations in the species. Samples from 4 breeding locations in Colorado and up to 4 additional locations outside of Colorado will be used to define within and between population levels of variation.

<https://symposium.foragerone.com/2022-racas/presentations/45446>

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## **IRAK-M suppresses melanoma cell invasion through the upregulation of a novel gene**

Daniela Gonzalez-Rivera, *Biomedical Sciences*

Mentor: Eduardo Davila

### **Abstract:**

According to American Cancer Society (2021), the survival rate for a localized melanoma is 99%. Once it has spread beyond the skin, survival rate drops to 66% and once the melanoma has spread to distant organs, the survival rate for patients plummets to 27%. Once a melanoma metastasizes, it becomes harder to treat, and survival rates begin to decline. Previous studies done in Davila's Lab showed that overexpression of IRAK-M, a protein expressed in immune cells and is involved in regulation of inflammation, decreased metastasis when overexpressed in melanomas (Geng et al., 2020). It was also found that with the overexpression of IRAK-M, another novel gene was upregulated. This gene is associated with the regulation of T cell receptors. We hypothesize that IRAK-M suppresses human cell invasion by upregulating this novel gene. I will be exploring the mechanisms of the gene by first overexpressing the gene in different highly metastatic cell lines through transduction, and then utilize invasion assays using HUVEC cells that act as a mimic for an epithelial cell layer, and Matrigel, that acts as a mimic for the extracellular matrix. This will explore the cells' ability to pass through these mimics compared to a control that are not overexpressing the gene. I will also perform an adhesion assay to explore the overexpressing cells' adherence ability with extracellular components such as collagen I, collagen IV and fibronectin. The overall objective is to develop treatments that will slow or stop metastasis.

<https://symposium.foragerone.com/2022-racas/presentations/45547>

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## **Legacies of the Denver Project: The Valley Highway**

Amanda Rees, *Social Sciences & Humanities*

Mentor: Manish Shiragokar

### **Abstract:**

Highways have displaced communities across the United States since the mid-20th century when the federal government began constructing highways and interstates from coast to coast. The process of eminent domain has been used to acquire land for these government transportation projects since since 1897, when the United States Supreme Court determined that the federal government has the power to condemn property “whenever it is necessary or appropriate to use the land in the execution of any of the powers granted to it by the constitution.” (United States v. Gettysburg Electric Railway). Since then eminent domain has been used by governments repeatedly to facilitate the construction of transportation infrastructure.

The Valley Highway is the 11.2 mile section of Interstate 25 that runs through Denver, Colorado from 58th Avenue in the north to Evans Avenue in the south and eminent domain was used to acquire land for the project. Initially constructed from 1948-1958, the interstate created a snaking footprint that displaced hundreds of families and dozens of businesses. Through a combination of archival research and geospatial analysis, this project will explore how the construction of the Valley Highway impacted the individuals and communities in one particular neighborhood adjacent to the highway. Where are the parcels that were impacted and who lived there?

<https://symposium.foragerone.com/2022-racas/presentations/45504>

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## **LGBT Acceptance and Integration in the U.S. Military Post-DADT and DOMA: A literature review regarding service members and their families**

Mary Span, *Social Sciences & Humanities*

Mentor: Dr. Elizabeth Allen

### **Abstract:**

The repeal of Don't Ask, Don't Tell (DADT) and Section 3 of the Defense of Marriage Act (DOMA) in 2011 and 2013, respectively, allowed Lesbian, Gay, Bisexual, and Transgender (LGBT) individuals to legally marry, serve openly in the military, and receive the same benefits as cisgendered and heterosexual counterparts. With a history of harassment, entrapment, and “drumming out” spanning back to the Revolutionary War, understanding the level of integration and support for LGBT individuals and their dependents in the military must be assessed post-DADT/DOMA. In this literature review, recent research on the integration of LGBTQ individuals in the military is presented so that current policy and support gaps can be identified and addressed, including improvements in access to counseling, family readiness groups (FRGs), and LGBT-specific support, as well as issues surrounding service member “outness” and unit morale. In this review, it has also been identified that current military research often omits LGBT individuals, and it is suggested that future research include this population so that results are more representative of serving military members and their families. It is also suggested that appropriate policy changes are made so that an LGBT identity is not a limitation for service members and their dependents to receive appropriate health care, counseling, and additional resources.

<https://symposium.foragerone.com/2022-racas/presentations/45491>

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## Life With Chronic Pain: Relationships Between Pain Duration, Opiate Use, and Report of Being Viewed as a Drug Seeker/Abuser by Healthcare Providers.

Valeria Bailey, *Social Sciences & Humanities*

Mentor: Dustin Goerlitz

### Abstract:

There have been large number of pain patients who feel they have been incorrectly perceived as a drug abuser by their health care practitioners despite the goal of better managing their chronic pain. Doctor-patient relationships are a key factor of pain management outcomes (e.g., with less treatment adherence or openness to alternative treatments when rapport is lacking). We aimed to examine relationships between opiate use, duration of chronic pain, and patient report of being viewed as a drug abuser by healthcare providers. **METHOD:** Data was collected from 4725 respondents to a national survey of those with chronic pain in the United States ( $M_{age} = 56.27$  years, 83.0% female). Relationships between variables were analyzed with chi-square tests of independence. **RESULTS:** Results showed a significant relationship between opiate use and report of being viewed as an abuser by a healthcare provider  $\chi^2(2, N=4577)=115.249, p<.001$ ), as well as being viewed as an abuser and pain duration  $\chi^2(12, N=4577)=232.908, p<.001$ ). For those reporting not having experienced being viewed as an abuser, there was a significantly larger proportion reporting no current opiate use. For those reporting occasionally being viewed as an abuser, there was a significantly larger proportion reporting current opiate use. Significantly different proportions were found for those reporting being viewed as an abuser occasionally, between those with pain durations ranging from 6-months to 20+ years, with greater proportions as duration increased. Similar results were found for those reporting being viewed as an abuser most of the time. **DISCUSSION:** Opiate use and duration of chronic pain were significantly associated with reports of being viewed as an abuser. Future studies should focus on factors that may be driving these effects. More research regarding doctor's perception is needed to check agreement of reported perceptions. Research is encouraged to improve treatment and doctor-patient relationships.

<https://symposium.foragerone.com/2022-racas/presentations/45378>

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## Mechanisms Underlying Rapid Exercise-Induced Stress Resilience in Females

Nashra Jamil, *Natural & Physical Sciences*

Mentor: Benjamin Greenwood

### Abstract:

Common stress-related disorders affect women more than men. Physical activity can enable stress resilience in both sexes, but little research has characterized exercise-induced stress resilience in females. We have observed that female rats are more responsive to the stress-buffering effects of exercise than are males. In females, 3 weeks of voluntary wheel running prior to stress exposure prevents the anxiety-like behavioral effects of inescapable stress, while males require 6 weeks of running. Although the expression of exercise-induced stress resilience occurs regardless of estrous phase of females at the time of inescapable stress or behavioral testing, the role of ovarian hormones during the 3 weeks of exercise in mediating rapid stress resilience is unknown. The goal of the current study is to determine the role of ovarian hormones in accelerated exercise-induced stress resilience in female rats. Ovariectomized and SHAM rats had access to either locked wheels or running wheels for 3 weeks. After 3 weeks, rats were exposed to inescapable stress and anxiety-like behavior (social avoidance and exaggerated fear conditioning) were assessed twenty-four hours later. Since females typically run more than males and ovariectomy eliminates the sex difference in wheel running, we limited the distance run in another group of females to determine the degree to which running distance contributes to a potential effect of ovariectomy. The data on the effects of ovariectomy on exercise-induced stress resilience are still being analyzed. Three weeks of both unlimited and limited running prevented stress-induced anxiety-like behavior, suggesting that running distance does not drive the rapid acquisition of exercise-induced stress resilience in females. Thus, if ovariectomy eliminates rapid stress resilience, it is unlikely this effect is simply due to a decrease in running. Results will shed light on the mechanisms underlying rapid stress resilience from exercise in females.

<https://symposium.foragerone.com/2022-racas/presentations/45553>

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## **Meta-analysis of Schizochytrium sp. as a Biomass Source for a Renewable Energy System with Net Zero CO2 Emissions**

Nicholas Dawson, *Natural & Physical Sciences*

Mentor: Kyle Crawford

### **Abstract:**

Mechanisms for reducing carbon dioxide emissions and new systems of renewable energy are critical in humanity's effort to reduce societies impact on the environment and ensure energy is available for future generations. This study introduced carbon cycling as a renewable energy system with net-zero CO<sub>2</sub> emissions as well as investigated its impact on greenhouse gas emissions, potential as a replacement to existing energy sources, and economical prospects. This study is the product of a thorough review of existing scientific literature with emphasis on the fields of carbon capture and biofuel production. Operating metrics from these two systems were synthesized with global carbon emission and energy consumption data to demonstrate the prospective impacts of carbon cycling. Economic reports for fossil fuel production and biofuel production were also compared to yield investment and revenue prospects. It was observed that to sequester current carbon dioxide emissions if only organic means of carbon capture were used in carbon cycling there is a major land deficit. However, the resultant biofuel would exceed existing energy needed. The initial cost of establishing a carbon cycle system was found to be roughly equivalent to alternative new energy sources but has a longer projected lifespan and the continuous production cost once established was less than fossil fuels. Although the feasibility of the carbon cycle system can be confirmed, given its stepwise nature there is still room for optimization and improvement. Specifically, additional research into the genetic modification of plants to improve carbon capture could help reduce space requirements.

<https://symposium.foragerone.com/2022-racas/presentations/45501>

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## **Methods of Senescence Induction in Human AC16 Cardiomyocytes**

Nikhitha Kastury, *Biomedical Sciences*

Mentor: Dr. Edward Lau

### **Abstract:**

Cellular senescence, induced by stress factors within a cell, is a state of cell growth arrest that has been found to contribute to age-related diseases. Senescent cells exhibit a particular phenotype that is generically characterized by increased expression of cell-cycle regulator proteins, increased expression of senescence associated beta-galactosidase, and increased oxidative mitochondrial stress. Particularly in the cardiomyocyte, this state of growth arrest contributes to many prevalent cardiomyopathies. However, while it is broadly known that oxidative stress and DNA damage inducing conditions can contribute to a cell becoming senescent, methods to induce senescence in cardiomyocytes effectively have yet to be systematically investigated. In particular, the particular lesions and concentrations that can adequately induce senescence as well as the particular pathway through which senescence is induced in each induction method are unknown. Accordingly, the aim of this study is to optimize the dosage and regimen of three pro-senescence insults (hydrogen peroxide, doxorubicin, and UV-C light) that will best induce senescence as measured by the associated senescent phenotype while gaining deeper understanding of differences in the pathways that are employed within a cell in the process of inducing senescence from different forms of stress. To do so, we used western blots and staining techniques in order to analyze relative expression of classic senescence markers in cells that were exposed to stress conditions as compared to healthy cells. The most relevant proteins that were compared were p16 and p21, cell cycle regulator proteins, and H2A.X, a double-stranded DNA damage protein. We found that in conditions of 500  $\mu$ M H<sub>2</sub>O<sub>2</sub>, 0.1  $\mu$ M Dox, and 5 mJ/cm<sup>2</sup> UV-C light, p21 and H2A.X were significantly upregulated and p16 was interestingly found to be significantly downregulated in all conditions. Preliminary mass spectrometry data used to compare the different insults showed some evidence of activation of

different senescent pathways. Samples insulted with Dox showed an enrichment in the apoptotic pathway while those treated with UV-C or H<sub>2</sub>O<sub>2</sub> showed enrichment in transcription and translation related pathways. Furthermore, we found that combinatorial treatment of H<sub>2</sub>O<sub>2</sub>, UV-C light and doxorubicin expressed increased mitochondrial oxidative stress as seen by MitoSox staining techniques. In summary, our results showed the different concentrations that can induce senescent phenotypes in cardiomyocytes and the differences in the phenotypes through different senescence induction methods.

<https://symposium.foragerone.com/2022-racas/presentations/45573>

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### **Michaelis-Menten Kinetics of Malic Dehydrogenase Catalysis for Understanding Dimethylbiguanide Inhibition of Gluconeogenesis**

Vrishank Bikkumalla, *Natural & Physical Sciences*

Mentor: Dr. Jefferson Knight Ph.D.

#### **Abstract:**

Dimethylbiguanide, more commonly known as metformin, is an antidiabetic drug which is known to inhibit gluconeogenesis; however, its mechanisms of action are not fully understood. Previous work has suggested possible inhibition of pyruvate carboxylase, responsible for the conversion of pyruvate into oxalacetate in gluconeogenesis. To study potential inhibition, we reconstructed the pyruvate carboxylase reaction in vitro, coupled with the malic dehydrogenase reaction which converts oxalacetate and the coenzyme nicotinamide adenine dinucleotide (NADH) into L-malate and NAD<sup>+</sup>. The rate at which NADH is converted to NAD<sup>+</sup> can be measured using UV spectroscopy to determine reaction rate, thus measuring potential inhibition. Importantly, inhibition of malic dehydrogenase must be ruled out to determine whether pyruvate carboxylase is inhibited. Here, in vitro enzymatic assays were conducted with the goals of 1) understanding the Michaelis-Menten kinetics of porcine malic dehydrogenase catalysis to determine the range of oxalacetate concentrations at which inhibition could be visualized and 2) determine whether dimethylbiguanide inhibits malic dehydrogenase. Kinetics of the malic dehydrogenase reaction were measured under a wide range of initial oxaloacetate concentrations. to determine initial reaction rate. The average reaction rate at each concentration was then determined and plotted to create a Michaelis-Menten plot. The range of oxalacetate concentrations above and below the Michaelis constant were then reacted in the presence of varying concentrations of dimethylbiguanide to determine whether inhibition was present. Overall, the results show whether dimethylbiguanide inhibits malic dehydrogenase. The study furthers insight into the kinetics of malic dehydrogenase and potential inhibition of dimethylbiguanide on pyruvate carboxylase.

<https://symposium.foragerone.com/2022-racas/presentations/45461>

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### **Microchips and mRNA: How Healthcare Workers are Discussing the COVID Vaccine with Patients**

Tanner Starnes, *Social Sciences & Humanities*

Mentor: Kari Campeau

#### **Abstract:**

Covid vaccination has been the subject of heated debate since the rollout of vaccines. With the stress placed on the healthcare system because of Covid, health care workers work strenuous conditions while counseling patients on vaccination. This presentation reports on findings from qualitative, semi-structured interviews with 17 healthcare providers across multiple specialties. Interviews were designed to elicit participating providers accounts of their (1) day-to-day working lives during the coronavirus pandemic, (2) perceptions of their patients based on Covid vaccination status, (3) perception of their own responsibility to discuss Covid vaccination with patients, and (4) their strategies for Covid vaccine communication. Findings illustrate the on-the-ground, improvisational strategies that healthcare workers developed to communicate vaccine information and perspectives to patients. Participating healthcare workers saw themselves as working against persuasive digital misinformation and used a range of

strategies, including dissemination of scientific evidence about Covid vaccines and personal stories about Covid and vaccination to compel patients to vaccinate. Participants also reported that vaccine communication involved additional emotional and time-based labor and that there was a lack of material resources to support patient-provider vaccine communication. Research is necessary to investigate the effectiveness of vaccine communication strategies on Covid vaccine uptake. These findings also suggest the need for targeted interventions to support health care providers as they face the ongoing repercussions of the pandemic.

<https://symposium.foragerone.com/2022-racas/presentations/45542>

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### **Molecular Dynamics and Quantum Chemistry Study of the NarK Antiporter from *E.coli***

Natalie Schultz, Nara Chon, *Natural & Physical Sciences*

Mentor: Hai Lin

#### **Abstract:**

Nitrogen is an essential element to life. Multiple forms of life necessitate the intake of nitrogenous compounds and export of nitrogenous metabolites for survival. Crucial to this function is the NarK protein, which transports nitrate ( $\text{NO}_3^-$ ) ion into the cell and nitrite ( $\text{NO}_2^-$ ) ion out of the cell<sup>[1, 2]</sup>. Here, we report the preliminary data in our study of the prototypical NarK antiporter from *E. coli* by conducting classical molecular-dynamics simulations and quantum-chemistry model calculations. We aim to explore protein conformational changes when the ions travel through the pore and to identify critical residues that interact with the ions along their journey. The results will inform future mutagenesis experiments.

<https://symposium.foragerone.com/2022-racas/presentations/45516>

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### **Neuroimaging Analysis for Identifying Potential Biomarkers in Patients with Epilepsy**

Zenetta Zepeda, *Biomedical Sciences*

Mentor: John A. Thompson PhD

#### **Abstract:**

Epilepsy is amongst one of the most common neurological disorders characterized by its unpredicted seizures effecting all age groups. Due to its unpredictable nature, epilepsy can impair quality of life not only limited to seizures, but other indirect effects such as, psychiatric disorders, cognitive deficiency, and adverse effects of medications. In addition, the seizures themselves can be fatal as well. Pharmaceutical intervention such as anti-seizure medications can be used as to maintain control over seizures but is not always the most effective measure for all patients with epilepsy. An unresponsiveness to antiepileptic drugs that causes uncontrollable seizures is classified as drug refractory epilepsy. Yet, exact origin and identifiable biomarkers are difficult to identify and diagnose, but cases such as medial temporal lobe epilepsy (mLTE) have been known to be associated with the limbic cortex. Although some studies have used brain asymmetry to localize and identify biomarkers in other neurologic disorders, the same mechanisms have yet to be performed with epilepsy in seizure origin. To perform accurate surgical intervention requires utilization of neuroimaging analysis to localize areas of the brain effected by seizures. Implanting stereotactic EEG, (sEEG) electrodes within the brain derives accurate localize of seizure origin. In this study, data collected from sEEG electrodes placement within the brain from pre-operative MR and post-operative CT scan of patients with drug refractory epilepsy, is analyzed by Vol Brain, an online MRI brain volumetry system to create a full volumetry report, to highlight potential biomarkers for patients with drug refractory epilepsy.

<https://symposium.foragerone.com/2022-racas/presentations/45565>

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## **Optimization of superconducting quantum interference device performance through use of a "quick noise" measurement circuit**

Jennifer Lofgren, *Natural & Physical Sciences*

Mentor: Martin Huber

### **Abstract:**

Through the unique properties of superconducting materials and interactions with magnetic fields, superconducting quantum interference devices (SQUIDs) are highly sensitive magnetometers. Characterizing this sensitivity is an important aspect of our group's research. In this application, a SQUID in its superconducting state produces a current dependent on the magnetic flux through its area. By reducing the area of a SQUID to the nanoscale, the nanoSQUID is able to detect magnetic fluctuations as small as the magnetic moment of a single electron. Because of this extreme sensitivity, the instrumentation for measuring the SQUID output must also have proportional sensitivity. Measuring the intrinsic noise of the nanoSQUID is necessary for evaluating the SQUID performance, since high levels of intrinsic noise reduce the sensitivity of the SQUID. The present method of measuring this noise using a fast Fourier transform (FFT) spectrum analyzer is time consuming, inhibiting our ability to characterize SQUIDs efficiently. To solve this issue, I developed a "quick noise" measurement circuit through a combination of analog filters and an amplifier. This circuit will measure the noise at a representative frequency without the need of a time-consuming FFT. I will present the design of the circuit and describe its performance.

<https://symposium.foragerone.com/2022-racas/presentations/45566>

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## **Optogenetic Stimulation of the Substantia Nigra to the Dorsal Lateral Striatum Circuit during Fear Extinction Prevents Fear Renewal**

Rebecca Han, *Natural & Physical Sciences*

Mentor: Benjamin Greenwood

### **Abstract:**

Many stress and anxiety disorder therapies target a mechanism known as fear extinction, but the long-term efficacy of exposure therapy is limited due to relapse phenomena such as fear renewal. Fear renewal occurs when conditioned fear responses return in contexts different from where extinction was learned. Activation of Substantia Nigra (SN) dopamine (DA) during fear extinction has been shown to promote fear extinction and protect against fear renewal, but the postsynaptic targets are unclear. Understanding the specific neural circuits that impact fear extinction will help protect against relapse phenomenon and develop targeted treatments and long-term success of exposure therapy. The goal of this experiment was to activate the SN-dorsolateral striatum (DLS) circuit during fear extinction to determine whether activation of this circuit during fear extinction is the postsynaptic target producing protective effects. We targeted the SN-DLS circuit due to the region's implication in habit learning processes that can be resistant to memory interference, such as contextual modulation. Adult Long-Evans male rats received either control virus or AAV-Chr2-hSyn-mCherry bilaterally into the SN, and bilateral optic ferrules in the DLS to selectively stimulate SN terminals in the DLS during fear extinction. Expression of neural activation marker cFos was used to verify the effectiveness of optogenetic stimulation. Activation of SN terminals in the DLS during fear extinction reduced fear renewal in a novel context while maintaining the fear extinction recall in the extinction context. The data suggest that the SN-DLS circuit is a novel target for freeing fear extinction memory from contextual modulation.

<https://symposium.foragerone.com/2022-racas/presentations/45530>

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## **Perivascular fibroblasts proliferate to cover the meningeal vasculature during postnatal development**

Kelsey Abrams, *Biomedical Sciences*

Mentor: Hannah Jones

### **Abstract:**

Perivascular fibroblasts (PVFs) are a fibroblast-like cell type known to surround the vascular smooth muscle layer of large-diameter vessels in the brain, choroid plexus, and meningeal space of the CNS. Recent studies have begun to characterize PVFs in the meninges and brain, however nothing is known regarding the origins and functions of PVFs. Previous research has shown that PVFs are present in the meninges embryonically but do not emerge in the brain until postnatal timepoints, revealing a major gap in the current literature regarding PVF development and emergence in the brain. Preliminary research suggests that brain PVFs are derived from the meninges, further research is needed to confirm this. In this study, we demonstrate that meningeal PVFs proliferate during late embryonic and early postnatal timepoints prior to their emergence in the brain. Meninges were dissected from Col1a1-GFP mice at ages E16, P0, and P2 followed by an EdU-based detection assay to fluorescently label cell proliferation. Using immunohistochemistry to label known markers of meningeal PVFs, blood vessels, and immune cells, we were able to quantify PVFs located on blood vessels. This data showed that PVFs are proliferating in the meninges and increase in proliferation over time, suggesting that PVFs may be increasing in numbers in preparation to migrate down the vasculature into the brain. These findings provide a novel insight into the poorly understood process of how PVFs develop and emerge in the brain.

<https://symposium.foragerone.com/2022-racas/presentations/45497>

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## **Play With Your Food**

Julianna Wright, Ryan Lavalley, Jamie Young, Dennis Mills, *Arts & Media*

Mentor: Jeff Merkel

### **Abstract:**

Play With Your Food investigates strategies that implement education through art and ameliorating current issues of traditional food practices and how they perpetuate food insecurities. By doing this, a more significant understanding than what currently exists about how to mitigate the environmental impacts of our food can be achieved. As local resource mitigation efforts offer innovative solutions to our deteriorating world, we aim to design and present a functional, vertical, and modularized hydroponic system with a reactive environment that allows plants to ask for help when they need it. Our novel approach to systemized growing incentivizes people with or without agricultural experience to engage with a dynamic interface that simplifies hydroponic processes. Our motivation for the education portion of the exhibition is centered around alternative farming, food miles, and agricultural sustainability. By engaging fellow students on campus through demonstrations of our immersive environment, the interactive exhibition aims to inspire and reeducate people on basic food systems using art to evoke wonder and awe. By conceptualizing food systems and how they encourage food insecurity, we are then allowed to address the scope of our project which is how interactive forms of alternative agriculture may influence the conditions of our existing agricultural sector through education. Our exhibition serves as an interdisciplinary representation of what it means to consider the origins of our food. Human health is negatively impacted by the lack of nutritious food produced in sustainable soils. Rather than transfer information and data about food injustice, the presentation of this project will aim to evoke emotions and foster a sense of empathy that allows the visitor of the installation to reflect on their preconceptions of food and sustainability and draw their conclusions.

<https://symposium.foragerone.com/2022-racas/presentations/45025>

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## **Queer Knowing: Sex Education in the Time of HIV**

Kaitlyn Lafferty, *Arts & Media*

Mentor: Yang Wang

### **Abstract:**

The HIV and AIDS epidemic of the late 1980s and early 1990s prompted an urgent standardization of education on the sexually transmitted disease, and in connection, the multitude of sexual practices in homosexual relationships. While a survey of mainstream sex education didactic publications reveals an evolution in our notions about sexual health in the United States, it excludes parallel discourses in the queer communities. My paper considers the ways in which queer independent publications, known as zines, appropriated images from scientific publications for content on queer sex education that included such subjects as healthy relationships and safe sex in the era of HIV and AIDS. Through a discursive look at the content of these zines and images from popular science education, I find that inaccuracies and misconceptions in our popular assumptions about sex and sexuality infiltrate scientific studies and in turn, influence visualizations of human bodies and sexual processes in sex education publications. When compared with mainstream images of sexual health, queer educational materials and art zines reveal their under-recognized importance as queer interventions in the field of science and in discussions of biology, sexuality, and sexual practice.

If I follow the argument correctly, what is the position of queer zines? Are they also “guilty” of using these misguided images or do they offer an alternative? This sentence isn’t super clear about that.

<https://symposium.foragerone.com/2022-racas/presentations/45852>

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## **Re-Envisioning Space on Auraria Campus**

Kaysie Larson, Allyson Olson, Ivonne Jacob-Flores, *Social Sciences & Humanities*

Mentor: James Walsh

### **Abstract:**

Sitting at the edge of 9th street historic park, the Casa Mayan, formally the home of one of Denver's most important cultural and community centers, sits empty. The space that once hosted artists, activists, and politicians has been converted into storage and a makeshift classroom a few times a week. Outside of this, the memories and legacy of the home goes unnoticed by the majority of the campus community. Through this investigation we hope to establish a new vision for the use of the Casa Mayan that reflects its legacy, history, and contributions to the shaping of the campus culture and identity. We see this as a fundamental shift towards creating equity, advocacy, and restorative justice in Auraria that shifts theoretical dialogue to tangible action through the creation of a usable space that is agreeable to the campus and displaced Auraria community.

<https://symposium.foragerone.com/2022-racas/presentations/45559>

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## **Regulating Facebook: Holding the Social Media Giant Accountable for It’s Unprecedented Influence in Our Democracy and Our Lives**

Ricky Abilez, *Social Sciences & Humanities*

Mentor: Dr. Serena Kim

### **Abstract:**

Social media sites and applications continue to dominate the internet, serving as an important tool for public discourse and daily business operations. In fact, Pew Research Center found that 70% of BIPOC individuals use social media for public awareness and political participation while 68% of all users cite it as a source for news. However, the costs of social media increasingly outweigh the benefits as major companies further centralize the

market, none more so than Facebook. The organization's monopoly power has caused extensive risks to mental health, political stability, election and homeland security, privacy, and market efficiency. Congress has not imposed new federal regulations on the internet or media companies since 1996. As a result, Facebook's problematic use of user data and internal algorithms have far surpassed the knowledge and comprehension of the public.

My research examines the current policy and three alternatives: 1) increased data transparency; 2) federal regulation; 3) reformed anti-trust laws. Five policy goals were used to measure the effectiveness of each alternative: 1) general welfare; 2) security; 3) transparency; 4) efficiency; 5) political feasibility. Though a combination of the three alternatives would be most effective, the analysis suggests that federal regulation is the most feasible stand-alone option. Federal legislation could introduce various rules and regulations that include restricted advertising, increased transparency, youth protection, required health warning signs, prohibited engagement-based ranking, required reporting of dangerous content, reforming Section 230 of The Communications Decency Act, and extensive taxes for noncompliance.

<https://symposium.foragerone.com/2022-racas/presentations/45487>

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### **Rocky Mountain Molly Maguires: Leadville, Colorado's Connection to Pennsylvania's History of Irish Labor Radicalism**

Kira Boatright, *Social Sciences & Humanities*

Mentor: Dr. James Walsh

#### **Abstract:**

The Irish were one of Colorado's most prominent ethnic groups in the nineteenth century. These immigrants were overwhelmingly working-class. Many were common laborers, railroad workers, and miners. Coming from a long history of oppression in Ireland and the U.S., Irish workers were often at the center of labor radicalism and activism in Colorado and throughout the U.S. One such site of Irish-led labor radicalism was the anthracite region of Pennsylvania. During the 1860s and 1870s, a secret society known as the Molly Maguires, who were mostly Irish coal miners, was extremely active in the area. These miners, coming from a history of colonial occupation and discrimination, believed the only way to protect their rights and wages was to organize and fight covertly against coal companies. Leadville, Colorado was another site of Irish labor radicalism. Leadville was one of the most Irish towns in the Rocky Mountain West in the nineteenth century and was also the site of two different Irish-led miner's strikes in 1880 and 1896. There is a connection between the anthracite region of Pennsylvania and Leadville. Leadville's parish records demonstrate a strong connection with the anthracite region, as many second-generation Irish residents list counties known for Molly Maguire activity as their place of birth. Additionally, court records, Pinkerton files, census data, newspaper archives, parish records, and city directories, revealed that some of the men who were accused of Molly Maguire activity fled to Leadville in the 1880s. These records revealed that over a dozen alleged Mollies sought refuge and opportunity in Leadville. By finding suspected Mollies who fled Pennsylvania and came to Leadville, my research makes a connection between the regions and contributes understanding of the role and perceptions of both Colorado and Irish workers in the larger narrative of labor activism and organization in America.

<https://symposium.foragerone.com/2022-racas/presentations/45329>

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## **Role of the Substantia Nigra to Dorsal Lateral Striatum Circuit in the Acquisition and Maintenance of Voluntary Physical Activity is Sex-Dependent**

Nadja Brown, *Natural & Physical Sciences*

Mentor: Dr. Benjamin Greenwood

### **Abstract:**

Understanding the brain circuits that contribute to the maintenance of exercise, particularly rapid escalation of exercise behavior in female rats, could help maximize exercise benefits. We have previously observed that the rapid acquisition of voluntary exercise in female, compared to male, rats is dependent on neural activity in the dorsal lateral striatum (DLS), a region involved in habit. Females have greater evoked dopamine (DA) activity compared to males, and DA in the DLS supports the formation of habits, which develop more readily in females. The DLS receives DA from the substantia nigra (SN), but the role of SN-DLS projections in acquisition and maintenance of voluntary exercise is unknown. The goal of the experiment is to determine the role of the SN-to-DLS circuit in the acquisition and maintenance of voluntary exercise and whether sex differences exist. We hypothesized that SN-DLS circuit activity is responsible for habitual exercise and the rapid escalation to habitual running displayed by females compared to males. An intersectional chemogenetic approach silenced the SN-DLS circuit daily, during the acquisition and maintenance of wheel running in both sexes. This is the first time a circuit-specific approach has been used to investigate neural circuits underlying exercise behavior. Inactivating the SN-DLS circuit reduced wheel running without impacting locomotor activity. The effect of SN-DLS inhibition was particularly robust during the maintenance phase of wheel running, when nightly running typically reaches high, stable levels. Females' running distance was reduced by SN-DLS inhibition on the first day of wheel access, whereas SN-DLS circuit inhibition reduced males' running behavior on the fifth day. This suggests that the SN-DLS circuit is necessary for the development of stable running "habits" in both sexes, and the more rapid development of exercise habits in females. The SN-DLS circuit therefore represents novel target for strategies aimed at increasing exercise participation.

<https://symposium.foragerone.com/2022-racas/presentations/45531>

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## **Runaway Art Market: Joana Vasconcelos's Navigation through Public and Private Art Dealings**

Nell Roberts, *Arts & Media*

Mentor: Yang Wang

### **Abstract:**

In recent decades, the influence of public art institutions such as museums and foundations has waned along with their diminished funding. Meanwhile, dealers, auction houses, and private collectors have been brokering record sales in the \$50-billion (annual) global industry. These new powerbrokers are now surpassing museum curators in determining and influencing art's commercial value. This new paradigm invites questions about what makes "good" art; how art's value is determined; and the relationship between the public art sector and private art market. By examining the successful career of Portuguese contemporary artist Joana Vasconcelos (b. 1971), which has benefited from both public and private acquisitions, this case study analyzes the shift of power from public museums to the private sector, and the consequences of such a shift when private collectors, particularly the ultra-wealthy, impact public access to art. This study finds that the swelling influence of private collectors has inflated art prices in ways that not only limit public museums' ability to acquire and exhibit new art, but also exerts disproportionate influence on the public's perception of what is "noteworthy" art. Through this case study of a single artist's career, this examination offers insight on a critical turning point for the contemporary art market and a possible roadmap for maintaining diversity and equilibrium necessary for a sustainable art market.

<https://symposium.foragerone.com/2022-racas/presentations/45854>

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## **Russian Imperialism and Czech Women's Gender Experience: How Russian Imperial Power Shapes Women's Lived Experience**

Zoe Vavrina, *Social Sciences & Humanities*

Mentor: Christoph Stefes, Katherine Mohrman, Martin Widzer, Sabina Pavlovska-Hilal

Abstract:

The Czech lands', today the Czech Republic, unique location between the West and the East makes it an important case study to apply postcolonial feminist theory. Like postcolonial feminists, Czech feminists emphasize that intersectional analysis is vital. However, the Czech lands are racially and ethnically homogeneous and considered class-less under communism. The limited nature of racial and class oppression in the Czech Republic elevates nation and empire as major categories to consider in an intersectional feminist analysis. Historically, Czech women's emancipation is integrated into national emancipation. As second-tier Soviet colonies, the Soviets exerted control over Czech lands through military, diplomatic, and economic influence. So, how does Russian imperialism affect Czech women? I assume Russian imperialism shifts how gender is produced and regulated, which changes how women experience gender. This study uses mixed methods, focusing on historical analysis of primary sources and descriptive statistical analysis. The Velvet Revolution in 1989 is highlighted as a critical juncture that ended Russian coloniality and therefore directly impacted women's experiences.

<https://symposium.foragerone.com/2022-racas/presentations/45469>

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## **Satisfaction in Pain Management: Roles of Active and Passive Coping, as well as Household Income.**

Emma Taylor- Westwood, *Social Sciences & Humanities*

Mentor: Dustin Goerlitz

Abstract:

**INTRODUCTION:** Over the past two decades there has been growing evidence that a combination of active (e.g., exercise, psychotherapy, and meditation) and passive coping (e.g., medication use) lead to optimal outcomes in chronic pain management. In relation to that, socioeconomic barriers (e.g., annual income) can often play a large role in access to proper healthcare. In the current study, we examined coping style and annual household income as predictors of satisfaction in pain management. We specifically hypothesized passive coping, active coping, and annual household income to significantly predict satisfaction in pain management as well as opioid use will predict unique variance in satisfaction in pain management, over and above chemical coping. **METHOD:** Data was collected from 4725 respondents to a national chronic pain survey in the United States ( $M_{age} = 56.28$  years, 83.0 % female). Predictors of use of satisfaction in pain management were analyzed via multiple linear regression with SPSS version 28. **RESULTS:** A multiple linear regression showed use of active coping ( $=.237, p=.016$ ), passive coping ( $=.194, p=.001$ ), household income ( $=.111, p<.001$ ), and opioid use ( $=-.452, p=.001$ ) to be predictive of satisfaction in pain management ( $R^2=.02, F_{3,4028}=28.763, p<.001$ ). **DISCUSSION:** In line with our hypothesis satisfaction in pain management was predicted by active and passive coping, as well as household income. As opioid use was negatively associated with satisfaction in pain management, this points toward the need for focus on alternatives to opioid-based pain management in particular. As each predictor was positively associated with satisfaction in pain management, interventions should focus not only on coping styles but also on addressing SES-based barriers to engagement with care. Future studies should examine specific factors (e.g., SES, race, ethnicity, health education, locus of control, and mental health) toward engagement with care to better guide individualized and systemic approaches to improving pain management.

<https://symposium.foragerone.com/2022-racas/presentations/45493>

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## **Secondary Structure and Selectivity of RNA Aptamers Containing 8-OxoG: Targeting Aminoglycosides**

Haydee Ramirez, *Natural & Physical Sciences*

Mentor: Marino Resendiz

#### Abstract:

Aptamers are single stranded RNA oligonucleotides with high affinity and specificity towards various targets such as small molecules, nucleotides, and proteins, making their use an attractive strategy in clinical treatments and diagnostics.<sup>1</sup> This work aimed to use 7,8-dihydro-8-oxoguanine(8-oxoG) in the construction of aptamers for distinct specificity toward their cognate targets. The unique hydrogen bonding ability of 8-oxoG, due to its inherited conformational changes may alter their range of possible targets, making their use a promising strategy. The 23-nucleotide long neomycin aptamer as modeled in Figure 1 was employed, where the oligonucleotides were modified at one position. To better understand the impact that 8-OxoG has on RNA structure, structural probing techniques were employed. While RNase T1 and RNase A experiments did not display differences, RNA SHAPE was useful in identifying structural changes.

<https://symposium.foragerone.com/2022-racas/presentations/45546>

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#### Secondary Structure Determination of a Random Coil Peptide

Aryana Rodgers, *Natural & Physical Sciences*

Mentor: Liliya Vugmeyster

#### Abstract:

Identifying and determining structures of peptides and proteins is important for evaluating interactions with the environment and other proteins. RC9 is a random coil 9-amino acid peptide that was designed to not have any secondary structures such as an  $\alpha$ -Helix or a  $\beta$ -Sheet. The focus was on confirming that RC9 is a disordered peptide with one dimension solution NMR and circular dichroism. One dimension NMR and circular dichroism analyzed RC9 in both low and high pH environments. In one dimension NMR, the chemical shifts of RC9 confirmed the peptide did have a disordered structure. Circular dichroism confirmed that RC9 was a disordered peptide. Hydrogen to deuterium exchange studies provide further details regarding structural features.

<https://symposium.foragerone.com/2022-racas/presentations/45350>

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#### Sense of Control Despite Pain: Roles of Opiate Use, Meditation, and Pain Severity

Daniella Paradiso, *Social Sciences & Humanities*

Mentor: Dustin Goerlitz

#### Abstract:

As chronic pain impacts greater than 10% of the global population, it is important to examine factors contributing to pain management and improved quality of life(QoL) in those with chronic pain. One construct shown to predict QoL is locus of control (e.g., sense of control in life despite pain). To examine factors contributing to pain management and QoL in those with chronic pain, the current study analyzed opiate use, meditation, and frequency of severe pain as predictors of sense of control in life despite pain. **METHOD:** Data was collected from 4725 respondents to a national survey of those with chronic pain in the United States (Mage = 56.28 years, 83.0% female). Predictors of sense of control in life despite pain were analyzed via multiple linear regression with SPSS version 28. **Results:** Although opiate use significantly predicted sense of control when entered in a model alone ( $\beta = .148, p = .009$ ), it was no longer a significant predictor when entered in the full model ( $\beta = .015, p = .784$ ). The full model showed use of meditation ( $\beta = -.054, p = .016$ ), and frequency of severe pain ( $\beta = -.398, p < .001$ ) to significantly predict sense of control in life despite chronic pain ( $R^2 = .043, F_{3,4721} = 72.094, p < .001$ ). **DISCUSSION:** Contrary to our hypothesis, use of opiates did not remain a significant predictor when entered in the full model; however, use of meditation and frequency of pain severity did significantly predict sense of control in life despite pain. These results build on the extant literature on locus of control in pain management and point toward targets for improved QoL and care in those with chronic pain. Future studies should examine additional factors impacting locus of control in pain management (e.g., SES, mental health,

and social support). As the current study utilized cross-sectional data, longitudinal research is additionally merited to examine mediational relationships of locus of control, QoL, and satisfaction in pain management.

<https://symposium.foragerone.com/2022-racas/presentations/45540>

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### **Severe Chronic Pain Frequency: Roles of Mindfulness, Opiate Use, Depression, and Locus of Control**

Haley Almeida, *Social Sciences & Humanities*

Mentor: Dustin Goerlitz

#### **Abstract:**

Despite numerous advancements in treatment (e.g., with greater understanding of appropriate opiate use in pain management and increased evidence for psychosocial treatment), chronic pain continues to impact many people globally. Provided additional focus over the last decade on psychosocial treatment, we examined related factors as predictors of frequency of severe pain. We anticipated frequency of severe chronic pain to be predicted by use of mindfulness and opiates, as well as depression and sense of control despite pain. **METHOD:** Data was collected from 4725 respondents to a national chronic pain survey in the United States ( $M_{age} = 56.28$  years, 83.0 % female). Predictors of severe pain frequency were analyzed via multiple linear regression with SPSS version 28. **Results:** A multiple linear regression showed mindfulness ( $B = .025, p = .036$ ) to significantly predict frequency of severe pain, when entered in a model alone; however, it was not a significant predictor when entered in the full model. In the full model, opiate use ( $B = -.293, p < .001$ ), depression ( $B = .060, p < .001$ ), and sense of control in life despite pain ( $B = -.083, p < .001$ ) significantly predicted severe pain frequency over mindfulness ( $B = .018, p = .115$ ) ( $R^2 = .025, F_{4,4720} = 99.058, p < .001$ ). **DISCUSSION:** Opiate use, depression, and sense of control despite pain predicted severe pain frequency in the full model. Based on our results, opiate use and sense of control in life are associated with less frequent severe pain, while depression is associated with more frequent severe pain. Contrary to our hypothesis, use of mindfulness was associated with more frequent severe pain, only when examined alone. These findings point toward important factors to consider when tailoring interventions for those with severe chronic pain. Limitations of the current study include cross-sectional data analysis and use of brief single-item self-report measures. Future studies should examine these and other factors that impact frequency of pain severity with longitudinal designs.

<https://symposium.foragerone.com/2022-racas/presentations/45538>

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### **Sex Work in the Age of Technology: How the World's Oldest Profession Has Adapted to Modern Times**

Ryann Tierney, *Social Sciences & Humanities*

Mentor: Randi Addicott

#### **Abstract:**

The sex work industry is a complex and ever-fluctuating industry that, just like other career fields, has been drastically affected by societal and cultural changes. In recent years, due largely to the global pandemic that forced isolation on society, the rise of the subscriber-based platform OnlyFans has been a new phenomenon that's impact on the sex work industry has not been closely examined. Already, however, researchers have realized the toll OnlyFans and their creators have had on the income and security of veteran sex workers (and even those who have been in the industry simply prior the beginning of the COVID-19 pandemic). Studies that have been conducted on this topic shed light on the present-day dilemma by publishing the voices and opinions of sex workers in Melbourne, Australia, either from online questionnaires or in-person interviews. It has been proven to be difficult for women to leave the sex work profession for a multitude of reasons including financial status, physical dangers, and limited mobility; therefore, sex workers must adapt professionally as the world around them changes and demand for their service fluctuates. A major finding from the studies is that although OnlyFans has made the sex work industry more accessible to the public, it has also reinforced the negative stigma typically associated with the industry and increased the competition



pool for sex workers. Based on these findings, it is clear that the current climate on OnlyFans is not sustainable for the majority of sex workers due to overexploitation and under compensation.

<https://symposium.foragerone.com/2022-racas/presentations/46775>

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### **Short Term Rental Regulation in the State of Washington**

Grace Amundsen Barnkow, *Social Sciences & Humanities*

Mentor: Wendy Bolyard, Serena Kim

#### **Abstract:**

There are more than ten thousand active short term rentals (STRs) in the State of Washington today, but half of the jurisdictions around the state have minimal, if any, applicable regulations. The regulations that do exist often have large loopholes like not applying if the rental does not offer meals to guests or only applying to those with more than three, five, or even seven listings. Unregulated vacation rentals have large negative externalities on the communities they are in, impacting housing, quality of life, equity, and the economy.

The purpose of this study is to establish the current state of regulations are on short term rentals in Washington state, examine how regulations impact Washington communities, and recommend types of regulation that most effectively balance mitigating the negative impacts of unregulated STRs while minimizing regulatory burdens and economic impacts. To accomplish this goal, a literature review examined impacts of this kind of rental, options for mitigation, lessons learned from other jurisdictions, and identified tools to indicate regulation performance.

Next, a summary of 100 of the 193 jurisdictions in Washington state was created with a topic analysis of the regulatory language for STRs in these jurisdictions, webscraping to consider the saturation of vacation rentals in these markets, and analyzing the results for trends. Case studies were completed of Tacoma, San Juan County, and Chelan County, including surveys of hosts, regulators, and residents analyzed using Qualtrics. This information and feedback was incorporated into creating a Model Code Generator, built in Qualtrics, drawing from the best of the 100 jurisdictions reviewed in this project. The generator uses a few simple questions for regulators to generate a comprehensible, moderate regulation with recommendations for a funding mechanism for dedicated staff for enforcement, and webscraping to collect data driven feedback.

<https://symposium.foragerone.com/2022-racas/presentations/45370>

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### **Spatial Distribution of Solar PV Deployment: An Application of the Region-Based Convolutional Neural Network**

Raven O'Rourke, *Tech, Engineering & Math*

Mentor: Serena Kim

#### **Abstract:**

This study is a comprehensive analysis of the socio-economic and environmental determinants of solar photovoltaic (PV) deployment in Colorado, USA. Using satellite imagery and computer vision frameworks based on a convolutional neural network, we estimated solar deployment rates of 142,132 U.S. Census blocks and 3,441 block groups in Colorado. Overall, 2.2% of roof areas in Colorado are covered by solar panels. Our machine learning model predicting solar deployment rates include ecological attributes (e.g., tree canopy cover and solar irradiation), demographic characteristics (e.g., income, age, ethnicity/race), energy infrastructure, market, and policy variables (e.g., solar PV permitting, inspection and interconnection (PII) rules, local governments' solar mandates, transmission line length/voltage, utility ownership), and social and natural disaster vulnerabilities (e.g., hail/wildfire/drought risks). Of the 41 natural and social environment factors included in ML models utilizing four algorithms (i.e., Random Forest, CATBoost, LightGBM, XGBoost), hail risks, median home value, and median household income, and the proportion of votes for the democratic party candidates are the most important predictors of solar PV adoption. The average marginal effects of median household income on solar deployment are lower in Black and Hispanic communities than White and Asian communities, indicating racial disparities in rooftop solar deployment. The findings from this

study can inform decision-making around grid infrastructure and distributed energy resource management in the ongoing energy transition.

<https://symposium.foragerone.com/2022-racas/presentations/45541>

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### **Staging the Embryonic Development of *Eublepharis macularius***

Madison Leeper, *Natural & Physical Sciences*

Mentor: Carlos Infante

#### **Abstract:**

Looking at squamate reptiles, a group that includes snakes and lizards, you will see a wide variety of limb development as well as complete limb loss. With snakes included in this group, there are 25 other species that have had varying lengths of limb loss over the course of time. The diversity within this group aids our research into the genetic morphology of limb development. In order to compare the limb development of squamates within the group itself and to other species, we chose to develop the Leopard Gecko, *Eublepharis macularius*, as a model organism. A more in-depth look at our *E. macularius* embryonic staging table shows that there are stages that are missing, leading to missing details that would aid in the comparison of *E. macularius* to other squamates as well as other model organisms such as mice or chickens. My paper addresses these gaps in the staging table with special attention to the gap between stage 30 *E. macularius* and stage 31 *E. macularius*. There is a large gap between these two stages that shows the paddling of the forelimbs, an increase in pigmentation in the eye, and the beginning of digit formation. I argue that there should be a stage in between these two stages mentioned above because increasing the number of stages is beneficial to our knowledge of how limbs develop in *E. macularius* so we can further the process of making *E. macularius* a model organism. In conclusion, the project sheds new light on the staging of embryos from *E. macularius* which then can further our knowledge of the limb loss phenomenon of snakes and other limbless species.

<https://symposium.foragerone.com/2022-racas/presentations/45510>

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### **Stuck in Motion**

Autumn Webster, *Arts & Media*

Mentor: Carol Golemboski

#### **Abstract:**

Anxiety plays a big role in my life, and the life of others. I document the burden of anxiety through my creative project in photography. I photograph myself through a series of self-portraits, revealing moments of panic attacks, and portraying metaphors such as going up into flames, drowning, and other themes that may have deep, hidden meanings. Drawing inspiration from Benjamin Henry Day Jr.'s "Benday Dots", and Andy Warhol's 1966 Pop Art Self-Portrait, I adapt my photographic work to correspond with these styles by altering the original image. Each image is individually constructed with a unique color palette and style, paired with image alterations that destruct the original quality and instead create motion similar to what I feel when I'm experiencing anxiety.

Anxiety is one of the most common mental health issues. The psychological effect of anxiety involves environmental awareness loss, straining physical sensation, situational avoidance, and a lack of basic functioning (Craske, 3048-3049). By delving into my world of anxiety, I bring a conscious awareness to myself and those viewing my photographs. My work speaks to my emotions and makes people think about how anxiety is looked at and how mental health issues are viewed. It starts a dialogue by making people open their eyes and really look at the issues at hand and be able to recognize certain symptoms and episodes in not only my photographs, but in other people as well.

Bringing awareness to anxiety provides coping mechanisms and knowledge to those dealing with it and prevents an increase in suicide rates. Anxiety disorders increase suicide rates by close to 8%. (Boden, 431). My photography captures the realism of anxiety and brings forth the concepts of tangibility and humanity. Documenting this will create a community which builds on finding and creating a solution to decrease anxiety intervals.

<https://symposium.foragerone.com/2022-racas/presentations/45279>

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### **Student Film, *Crooked Night***

Alexander Rocha, Mary Amoroso, *Arts & Media*

#### **Abstract:**

Under the guise of being a classic monster-slaying horror movie, it is a representation of the struggle the Latinx (and any other marginalized community) go through daily. Feeling powerless against a bigger entity, being dismissed and overlooked, and accepting a call to action rising to the occasion to make an active change for the betterment of yourself and others. *Crooked Night* gives a much-needed voice to the Latinx community. Using subtle social commentary, this film hints specifically to the violent prejudices members of the Latinx community in the United States face daily.

<https://symposium.foragerone.com/2022-racas/presentations/45463>

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### **Sympathetic Sociopaths: Trauma and Villainy in Superhero Cinema**

Stephanie Emelio, Joel Larson, *Social Sciences & Humanities*

Mentor: Dr. Colleen Donnelly

#### **Abstract:**

In the past decade, a new trend has emerged in blockbuster cinema: characters who previously have been depicted as simply evil are now represented as coping with past trauma, unable to manage their internal pain. While this movement could be representative of a de-stigmatization of mental illness and a cultural call to take trauma seriously, we should ask how this string of mentally ill villains affects real-life trauma survivors. Media has wide-reaching cultural influence, and as such we should take these trends seriously for their potential to influence perceptions of the actual effects of trauma on real people. To study this phenomenon, we reviewed Marvel and DC superhero films from the last 10 years, examining the more homicidal villains for backstories of trauma and mental illness. Our research indicates a significant rise in a new sort of supervillain: a sociopath who begs for the audience's sympathy even as they wantonly destroy human life. This pattern in movies and media has the potential to create an overwhelmingly negative picture of real trauma survivors by inaccurately portraying violent, sociopathic tendencies as being caused by traumatic (cPTSD/childhood trauma) incidents.

<https://symposium.foragerone.com/2022-racas/presentations/45556>

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### **Synthesizing photodegradable biomaterials to study chronic lung diseases**

Andrew Colson, *Biomedical Sciences*

Mentor: Rukshika Hewawasam

#### **Abstract:**

Chronic lung diseases, such as idiopathic pulmonary fibrosis, are driven by how cells respond to changes in their surroundings. Biomaterials are a valuable tool for modeling these interactions *in vitro*. Our laboratory has designed a new photodegradable biomaterial to study how dynamic changes in the mechanical properties of the extracellular matrix (ECM) influence cellular responses. The goal of this project was to synthesize the photodegradable biomaterial precursor. This synthesis consisted of a six-step process that involves the use of basic organic chemistry skills and

knowledge. First, a commonly used photodegradable group, o-nitrobenzyl ether, was synthesized (step 1 to step 4) and purified. Then it was attached to 8-arm, 10 kg/mol poly(ethylene glycol) (PEG). Next, this macromer was acrylated to facilitate thiol-ene Michael addition in hydrogel formation. The photodegradable group was successfully synthesized as characterized via <sup>1</sup>H NMR at each step. Attachment of PEG to the photodegradable group was successful with over 99% end group functionalization. Finally, the PEGylated photodegradable product was acrylated with only 60% functionalization. Several attempts were carried out to increase functionalization of the acrylated photodegradable hydrogel precursor and optimization of this final step is ongoing. Ultimately, the progress made here in synthesizing the photodegradable precursor will be informative for engineering dynamically tunable biomaterials to study how cells respond to changes in the local microenvironment and improve our understanding of chronic lung diseases.

<https://symposium.foragerone.com/2022-racas/presentations/45527>

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### **TAGGING IME4 in *CANDIDA ALBICANS***

Hamza Ahmed, *Biomedical Sciences*

Mentor: Allison Swain

#### **Abstract:**

*Candida albicans* live as harmless commensals in different part of human body. The overgrowth of these organisms will lead to disease. In addition, a main goal of *C. Albicans* research is to investigate response of multiple cells to the environment in the human host, in particular to enable colonization and infection. *C. albicans* is distantly related to *Saccharomyces cerevisiae* and they share conserved genes at the mating type locus (MTL). However, there are distinctions between the mating cycle of these two species. The *C. albicans* mating cycle involves concerted chromosome loss instead of meiosis, and they must undergo a phenotypic switch from white- to opaque in order to mate. In *C. albicans*, IME4 regulates white-opaque switching, however where the IME4 mutant has more stable opaque cells than wild type (WT). Is the protein expression of IME4- regulated by white-opaque switching? Where is the IME4 protein found in the cell? Using long oligo nucleotide that has a complementary plasmid to the fluorescent protein. about 75bps of IME4, will be inserted in 3' intergenic region. Once it is generated, it will go under microscopy analysis.

<https://symposium.foragerone.com/2022-racas/presentations/45825>

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### **The Association between Mate-Poaching Behaviors and Trust Toward Current Partner**

Nicholas Garrick, *Social Sciences & Humanities*

Mentor: Dr. Elizabeth Allen

#### **Abstract:**

In the general topic of relationship infidelity, some research has focused on the concept of “mate-poaching,” or the behavior of trying to attract someone who is already in a relationship with someone else as one’s sexual partner. Individuals engaging in mate-poaching may themselves be in lower-quality relationships. One marker of relationship quality is trust. Moreover, individuals who are relatively more attracted to potential alternatives to current partners (e.g., more tempted to “cheat”) or who engage in more deception with their partners may project these feelings and behaviors onto the partner. That is, extradyadic attractions may be associated with beliefs that one’s partner is unfaithful, or being deceptive towards the partner may be associated with beliefs that the partner is dishonest. The goal of the current study is to explore a possible implication of these types of findings; specifically, to examine if a higher self-reported frequency of one’s own mate-poaching behavior is a correlate of lower levels of trust regarding one’s current romantic partner. This hypothesis was tested using a sample of 210 couples who were either married or seriously dating for a minimum of one year. Analyses were run for the subset of males and females in the sample who completed both self-report measures of mate-poaching and trust in a manner protecting the confidentiality of

responding for each partner. The male partner's frequency of mate poaching was significantly related to lower levels of trust in the relationship/partner ( $r = -.26$ ,  $p$

<https://symposium.foragerone.com/2022-racas/presentations/45508>

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### **The Association of Combat-Related Killing With Soldier Reintegration Post Deployment**

Katie Bieser, *Social Sciences & Humanities*

Mentor: Dr Elizabeth Allen

#### **Abstract:**

Research on the impact of combat related killing among service members suggests that such action relates to higher levels of psychological difficulties such as posttraumatic stress, as well as difficulties in interpersonal functioning. In such instances the familial reintegration period (i.e., coming home after deployment) may be more challenging. The purpose of the current study was to evaluate family reintegration post-deployment for married Army soldiers who do or do not believe that they killed or may have killed someone in their most recent deployment. This question was tested using survey data from male soldiers participating in a larger study of individual and relationship functioning. Of the 99 soldiers who had faced combat in the prior year, 29 reported combat related killing and 70 reported no combat killing during their most recent deployment. These respondents completed a Family Reintegration Scale, which assessed family patterns after deployment including difficulty re-establishing roles in the home, feeling like an outsider in the home, and feeling stress and distance with family members. Results indicated that soldiers who reported combat killing had higher levels of reintegration difficulties ( $M = 2.11$ ) than soldiers who reported no combat killing ( $M = 1.50$ ) in their most recent deployment ( $t(40) = 3.41$ ,  $p < .001$ ). These findings support the existing literature regarding the correlates of combat related killing with a range of individual and relationship problems. Although killing in combat is complex and can also be experienced as heroic within a warrior ethos, exploration of this issue with returning soldiers, and recommendations for improved family integration for soldiers who struggle with the aftermath, appear warranted. For example, referrals to Impact of Killing (IOK), a cognitive-behavioral treatment aimed at reducing mental health symptoms and functional impairment for Veterans may be useful for some soldiers (Maguen et al. 2017).

<https://symposium.foragerone.com/2022-racas/presentations/45346>

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### **The Brusselator: Entropy Production Surrounding a Hopf-Bifurcation**

Gessner Soto, *Natural & Physical Sciences*

#### **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 is most basic type of non-stationary steady-state. 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. Arrangements that exist within an open context are able to indefinitely be maintained away from their preferred distribution: sustained exchange with the external environment is required to mediate this deviation from the equilibrium distribution. The net cumulative flow of matter through a system – referred to as “internal entropy production” – is greater than zero when the preferred distribution of the contained arrangement has not actualized. Only arrangements that are – even transiently – away-from-equilibrium have the possibility of accessing a non-stationary steady-state. 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/2022-racas/presentations/41492>

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## **The Effects of Copper and Nickel on *Nitrosomonas oligotropha***

Nicole Laurita, *Natural & Physical Sciences*

Mentor: Dr. Annika Mosier

### Abstract:

In Colorado streams, microbes perform vital steps in the nitrogen cycle which entail cycling between gaseous dinitrogen and its bioavailable forms. While every cell needs nitrogen, too much bioavailable nitrogen leads to eutrophication and its devastating effects on the environment. Current anthropogenic pollution is overloading these nitrogen cycling microbes and threatening the health of Colorado freshwater ecosystems. This study examines how ammonia-oxidizing bacteria (AOB that convert ammonia into nitrite) respond to essential metals that can disrupt cellular processes and even cause cell death at high concentrations: copper, nickel, and zinc. We report the enrichment and near-complete genome sequences of three *Nitrosomonas oligotropha* AOB representatives from the South Platte, Cherry Creek, and Cache la Poudre rivers. A global biogeography analysis (based on a query of over 270,000 SRA submissions from 16S rRNA gene amplicon studies) showed *N. oligotropha*-like sequences were commonly found in freshwater and wastewater environments across the globe and were largely absent from soil or marine settings. Our Colorado *N. oligotropha* genomes contained copper, nickel, and zinc resistance genes. Future efforts will include transcriptomics to measure expression of different genes under varying dissolved copper, nickel, and zinc concentrations as the Colorado AOB move from homeostasis to stress. By studying the degree of metal tolerance, we aim to identify Colorado streams where *N. oligotropha* will be negatively impacted by elevated dissolved metal concentrations to guide remediation efforts.

<https://symposium.foragerone.com/2022-racas/presentations/45269>

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## **The impact of temperature stress on gene expression changes across development in *Drosophila melanogaster***

Jenna Tomkinson, *Natural & Physical Sciences*

Mentor: Dr. Gregory Ragland

### Abstract:

Climate change impacts all parts of the world, with some areas experiencing greater changes than others. The ability for organisms to survive in changing environments can be attributed to both adaptation (the change in genotype based on natural selection) and phenotypic plasticity (the change in phenotype due to the environment without change in the genome). *Drosophila melanogaster* are ubiquitously distributed insects that show strong physiological plasticity and serve as models for physiological buffering of environmental change. In addition, *D. melanogaster* is a prime model for genetics and developmental biology because they share many features with mammalian species like cellular and tissue remodeling during development. This experiment measured whole-transcriptome responses to thermal stress across development, an indicator of how genes are differentially regulated to affect physiology. Specifically, gut tissue is known to be important during thermal responses. Yet, no one has explored the phenotypic plasticity in the whole-gut tissue of the juvenile (larval) stage in response to environmental temperature stressors. In this experiment, we measured the impact of cold-stress treatments on the gut transcriptomes of juvenile flies, then compared those results to a previous experiment applying the same treatments to adults. When comparing juvenile to adult transcriptomes, we found there are different physiological responses to the same cold-stress treatments, demonstrating phenotypic plasticity within and across the two life stages. This demonstrates the importance for models predicting change in populations confronting climate change which should consider the complex relationship between physiology and the environment during development. Understanding this model of *D. melanogaster* life stages can help reveal the evolutionary mechanisms used to respond to climate change.

<https://symposium.foragerone.com/2022-racas/presentations/45498>



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## The Role of Sleep Timing on Headache and Emotional Health for Adolescent Girls with Chronic Migraine

Emma Conroy, *Biomedical Sciences*

Mentor: Michelle Clementi

### Abstract:

**Introduction:** Chronic migraine is a debilitating condition that affects women at a rate 3x higher than men and affects 10% of the pediatric population. Many studies have examined interactions between migraines, sleep disturbances, and emotional health but there has been less research on this in adolescence, a developmental period when sleep dramatically changes due to biological and social factors. During adolescence, there is a natural shift in circadian rhythms to later sleep timing. When significantly later sleep timing is out of synch with early morning expectations (e.g., early school start time), this misalignment can contribute to increased psychological and physical health risks. The current study aims to describe circadian factors (sleep timing) among adolescent girls with chronic migraine and to examine associations between sleep timing, headache characteristics, and emotional health.

**Methods:** In this study a sample of 37 adolescent girls (ages 12-18) diagnosed with chronic migraine (15 headache days/month) completed questionnaires about sleep, then wore a wristwatch (actigraph) that measure sleep based on movement and light for 10 days. They also provided daily ratings of headache frequency/severity, anxiety, stress, and sadness while they were wearing the actigraph. The circadian variables related to sleep timing were measured by: a self-reported questionnaire that screens for risk of delayed sleep phase syndrome (a circadian rhythm sleep disorder in which a person's sleep is delayed at least 2 hours beyond the socially acceptable or conventional bedtime), a self-reported questionnaire assessing chronotype (i.e., sleep timing preference), and the average midpoint of the participants' sleep episodes based on actigraphy data.

**Results:** Regarding delayed sleep phase, 43.2% of participants were rated in the "caution" or "high-risk" range for meeting criteria for delayed sleep phase syndrome. Regarding chronotype, 43.2% of participants reported an evening preference, 24.3% had a morning preference, and 27% had intermediate preference. The average sleep midpoint of participants' sleep episodes was 3:36 AM. Correlations between sleep timing and headache characteristics revealed a significant correlation between delayed sleep phase and headache severity, ( $r=3.22$ ,  $p=.05$ ). No sleep timing variables were correlated with headache frequency. Regarding emotional health, delayed sleep phase was significantly correlated with anxiety ( $r=4.09$ ,  $p=.02$ ) and stress ( $r=.47$ ,  $p=.01$ ), but only marginally correlated with sadness ( $r=.32$ ,  $p=.07$ ). Chronotype was significantly correlated with anxiety ( $r=-.55$ ,  $pr=-.51$ ,  $pr=.41$ ,  $p=.02$ ).

**Conclusion:** This study demonstrated that higher risk of delayed sleep phase syndrome was associated with higher headache severity. Higher risk of delayed sleep phase syndrome, eveningness chronotype (later sleep timing preference), and later sleep midpoint were significantly correlated with higher anxiety/stress. However, higher rates of sadness were only related to one sleep timing variable (higher risk for delayed sleep phase syndrome) at a trend level. Future studies should look into why worse emotional health is associated with later sleep timing and see if there is any relationship with school start times.

<https://symposium.foragerone.com/2022-racas/presentations/45480>

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## The Study of Environmental Triggers That Lead to Non-Immunoglobulin E Mediated Mast Cell Activation

Courtney Moeder, *Biomedical Sciences*

Mentor: Dr. Jared Brown

### Abstract:

Systemic Mastocytosis (SM) and Mast Cell Activation Syndrome (MCAS) are two of several mast cell diseases that significantly affect the quality of life for those that present any one or more of many possible conditions. Symptoms range wide and may manifest as allergic reactions, hives, anaphylaxis, syncope, inflammation, and other indicators, singularly or in varying combinations. As effector cells of the immune system, mast cells are "activated" by two mechanisms, Immunoglobulin E (IgE) and non-Immunoglobulin E (non-IgE) mediated degranulation. Non-IgE mediated activation is not yet well-understood in the medical community, especially in cases of mast cell disease

that do not present with elevated IgE, as is thought to be the case in chronic idiopathic urticaria. Metabolic activity of non-IgE induced mast cell degranulation will be observed after exposure to environmental particulate triggers such as silica, air pollution, and nanoparticles. Further study of Thioredoxin-Interacting Protein (TXNIP), a potential regulatory protein of mast cells, will help to illuminate the mechanisms that induce non-IgE degranulation. The aim of my project is to discover and distinguish the pathways of non-IgE mediated mast cell activation by pernicious environmental agents. This continued and expanded research will provide the data necessary to identify the mechanisms of non-IgE mast cell degranulation. The science will lead to improved guidelines for diagnosing mast cell disease, refined and new medical therapies, potential lifesaving treatments, and a happier and healthier quality of life for those suffering from mast cell disease (Brown, 2020).

<https://symposium.foragerone.com/2022-racas/presentations/45482>

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### **The Veil of Inclusion: Women, Magazines, and Mirrors**

Chloe Campbell, *Arts & Media*

Mentor: Bill Adams

#### **Abstract:**

*The Veil of Inclusion* is a study on the influence of fashion magazines and body dissatisfaction among women. This project is also a creative and personal exploration of self. By creating a series of photographs, I wanted to convey the emotional and psychological toll many women face when looking through a magazine or into a mirror. From beauty and fashion to exercise and health, women are consistently faced with the pressures of optimization. In 2004, Dove established the Real Beauty campaign to begin a positive conversation around women's beauty and self-esteem. A global study was conducted and researchers found that only 7% of women could describe themselves as beautiful. From acne, blemishes, and scars to teeth, cheeks, and eyes, many women remain unsatisfied with their appearance. While there is an attempt in current media to project more inclusion, the models remain predominantly similar in height, weight, and race. Such features remain wholly unattainable for most women, thus creating a poor relationship with body and image. Just as photographs in magazines influence young women's beauty and body standards, I want the photographs I have created for this project to carry that same kind of influence and instill a sense of dysmorphia and distortion. Personally, I have suffered with unrealistic beauty and body standards throughout my life, attempting to achieve an ideal body image by any means necessary. This project has allowed me to face my own insecurities and continue the conversation to change the narrative of women, magazines, and mirrors.

<https://symposium.foragerone.com/2022-racas/presentations/45935>

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### **The Western Federation of Miners and Electoral Politics**

Charlie Hindman, *Social Sciences & Humanities*

Mentor: James Walsh

#### **Abstract:**

In parts of Europe, and the Eastern region of the United States organized labor was intimately involved in every level of electoral politics, unions in the mountain West had a far more contentious relationship with electoral politics. Around the turn of the twentieth century, the Western Federation of Miners (WFM) was one of the most formidable industrial unions in the United States. Throughout its history, the WFM had a difficult relationship with political parties and would eventually adopt a policy of "independent political action", supporting candidates for office on a case-by-case basis, and choosing to focus instead on educating the members on economic and political matters. This project, using a variety of primary and secondary sources related to the period from 1890 to 1910, seeks to understand the reasons the WFM chose to abstain from affiliating directly with an existing or new political party. This is done through an exploration of the potential impacts of violent state repression of workers, the geographic fluidity of the working

class, and the capture of the political system by business interests. This study will explain the relative lack of socialistic or social-democratic politics within the mountain West region of the United States.

<https://symposium.foragerone.com/2022-racas/presentations/45544>

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### **The Effect of Post-translational Modifications on Amyloid Beta Fibrils at the N-terminal Domain**

Matthew Sawaged, *Natural & Physical Sciences*

Mentor: Liliya Vugmeyster

#### **Abstract:**

Amyloid- $\beta$  protein ( $A\beta$ ) derived from the amyloid precursor protein (APP) is specially linked to Alzheimer's disease. The significance of this neurodegenerative disease induces impaired cognition, memory, and physical behaviors. These amyloid beta fibrils contain a propensity to be arranged in neurotoxic oligomers which bind to neural receptors (3).  $A\beta$  peptides can exist in a series of isoforms and protofibrils, which make them prone to post-translational modifications (PTMs), thereby evoking a molecular switch which prompts aggregation (2).

In this study, we will examine the effect on flexibility of PTMs on the N-terminal domain and in the hydrophobic core of fibrils.  $A\beta_{(1-40)}$  peptides that contain a deuterated label on the side chain of individual residues were obtained to generate samples of  $A\beta$  fibrils with corresponding morphological features, such as the 3-fold symmetric and the 2-fold symmetric polymorphs of the native form. The preparation of these fibrils was tasked through cross-seeding of wildtype seeds containing the deuteration label of one residue and a variant protofibril. The main post-translational modifications investigated in this project is the phosphorylation of serine at position 8 (pS8). Methods for "cross-seeding" included buffer preparation at physiological pH (7.4), miniprep/semi-bulk/bulk preparation techniques via ultrasonication, success of cross-seeds were established through transmission electron microscopy. Following this process, samples were lyophilized for solid state NMR via quadrupolar echo pulse sequencing to detect dynamics in the flexibility of the hydrophobic core of fibrils. We found that motions of the deuterated side chain persists at low temperatures, indicated the dependence of flexibility of the hydrophobic core on temperature.

<https://symposium.foragerone.com/2022-racas/presentations/45529>

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### **Thrust: Runic Blades**

Alex Verkest, *Tech, Engineering & Math*

Mentor: Katherine Goodman

#### **Abstract:**

Thrust: Runic Daggers is a first-person puzzle platforming game that has you exploring a long-forgotten tomb using two emotive magical daggers; one grants you the ability to teleport to where it's thrown, while the other will return to you after being thrown. Using these two abilities you will traverse the environment and solve puzzles to reach the end of the tomb and return the daggers to their resting place.

<https://symposium.foragerone.com/2022-racas/presentations/45557>

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### **Understanding Access and Cost Of Burn Care in Low-and Middle-Income Countries**

Jyotshila Dhakal, *Social Sciences & Humanities*

Mentor: Corey Bills

#### **Abstract:**

Each year, it is estimated that about 140,000-180,000 deaths every year are caused by burns. Vast majority of them occur in low (LIC)-and middle-income (LMIC) countries because of inadequate access and cost of burn care.<sup>1</sup> An

abundance of research on quality care reveals that Emergency Medicine Services (EMS) is a critical area in which many regions lack access and cost effectiveness to burn care. However, with the information from such research, action has not been taken by many to lower the cost and find better treatment for burn care. Also, barriers that have been discussed in past systematic reviews have focused only in a singular area or community and treatment available there. However, this study focuses on treatments available in both LMC and LMICs. This includes a scoping review of English language peer-reviewed literature articles related to the measures cost of burn care in LMICs and English language studies describing access to burn care in LMICs, as defined by the World Bank Economic definitions. We categorized articles by the five characteristics: affordability, availability, accessibility, accommodation, and acceptability as described in the study. Among quantitative articles, the outcomes related to various components of burn care cost are summated where appropriate. The qualitative articles described the burn care access in certain areas based on the community's experience. In the beginning, abstracts of 2100 articles were screened to identify which ones met the criteria. After abstract screening and full text reviews, 97 articles met study inclusion criteria because of its heterogeneity in the methodological design, rested on varying definitions of access, and reported numerous outcomes. This revealed which articles would help analyze different access characteristics present in global communities.

<https://symposium.foragerone.com/2022-racas/presentations/45515>

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### **User friendly data analysis software to track mouse reaching activity during enhanced motor learning**

Elise Carter, *Tech, Engineering & Math*

Mentor: Cristin Welle

#### **Abstract:**

Motor learning can potentially be improved via specific modulation of the nervous system. Specifically, precisely timed Vagus nerve stimulation (VNS) can be utilized to accelerate motor performance. Mice performed a reaching task in a closed-loop behavioral system that tracks movements and stimulates the Vagus nerve. The enhancement of the reaching task should be reflected in kinematic parameters which quantify the enhanced motor learning. The large kinematic data sets produced can be tedious to process without coding experience. A user-friendly program was developed in MATLAB to perform modular analysis of the kinematic data resulting in visual representations of reach trajectories as well as comparisons between reaching sessions and different animals. Visualization of the data allowed for exploration into which specific kinematic parameters are leading to enhanced learning. This data pipeline allows for efficient data analysis in the lab regardless of coding experience and is applicable in multiple investigations utilizing the same behavioral system.

<https://symposium.foragerone.com/2022-racas/presentations/45539>

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### **Using microfluidics to isolate cells in sputum samples for early evaluation of immunological features of rheumatoid arthritis**

Mandi Burcl, *Biomedical Sciences*

Mentor: Kristin Sturm

#### **Abstract:**

In an ongoing study, microfluidics is being evaluated as an alternative to flow cytometry for isolating neutrophils and macrophages from sputum samples to evaluate autoimmune disorders like rheumatoid arthritis (RA). The abundance of immune cells present in lung tissue makes sputum a priority for further investigation and new techniques are needed to effectively assess macrophages in sputum samples without altering their function.

Immune cells of interest include neutrophils and macrophages. Neutrophil extracellular trap (NET) formation is an important immune response in RA. Preliminary studies show that the proportion of neutrophils undergoing NETosis,

the process in which neutrophils decondense and expel chromatin in complex with associated proteins, is higher and macrophages are less efficient, in participants who are at-risk or have already been diagnosed with RA versus healthy controls [3].<sup>1</sup> It is hypothesized that macrophages are responsible for clearing NET remnants and can be assessed for functionality to determine if they are effectively able to clear them. Previous methods to isolate airway macrophages (ie, flow cytometry) may alter their function by interacting with surface-bound antigens. By using microfluidics, we aim to eliminate this barrier to accurately assessing macrophage function, giving us a better idea of their role in autoimmune disorders such as RA.

<https://symposium.foragerone.com/2022-racas/presentations/45536>

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### **Utilizing Small Molecule Binding to Assess Protein Homology Models**

Alexander Plonski, *Natural & Physical Sciences*

Mentor: Scott Reed

#### **Abstract:**

Protein structure prediction has been a challenge in computational biology in which decades of work have been focused on finding solutions to this problem. Recent advances made by AlphaFold2, an artificial intelligence from DeepMind has shown promise in predicting protein structures deduced from experimental methods such as X-Ray crystallography and solution NMR spectroscopy. While AlphaFold2 has made great progress in predicting the backbone structure of a protein, limitations exist when predicting the molecular level details such as side chain placement. These factors are crucial in drug docking, which requires precise binding site information. Here we have created a library of 1334 small molecules to examine how reproducible their binding was to AlphaFold2 and experimental structures using the docking program, QuickVina-W. We analyzed over 226,200 drug-protein interactions which have shown that the better the protein backbone quality of the AlphaFold2 model, the greater the similarity between the small molecule docking to the experimental and modeled structures. Results showed that higher quality models were able to bind a greater fraction of small molecules in the same binding site as experimental structures did. Additionally, we have found that specific subsets of the library were useful in identifying small differences between the best of the best modeled structures when looking at docking results. Specifically, when the number of rotatable bonds in the small molecule increased, differences in binding sites became more apparent. More flexible molecules can be used as a method to optimize homology models through assessing differences in binding between structures.

<https://symposium.foragerone.com/2022-racas/presentations/45362>

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### **Venus Inn: How Women's Liberation Means More Than Killing What Destroys You**

Becka Jimenez, *Arts & Media*

Mentor: Eric Jewette

#### **Abstract:**

Hollywood is a business of creativity that inspires us all. The issue is that a lot of the films being made aren't a good representation of all people. From a lack of diversity on set, to a lack of understanding and diversity on screen, Peyton Hagerty, the writer, and director, sought to find a way to change this. Venus Inn is a film that explores sex trafficking, domestic abuse, and assault and themes of repurpose and strength. A lot of times films made about these subjects don't do the survivors justice and focus on making the main character a weak and helpless woman. This film flips that narrative by focusing on strong female leads and liberation from trauma. We also build a crew of almost all women and queer individuals to tell this tale of the Venus Inn.

<https://symposium.foragerone.com/2022-racas/presentations/44148>

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## **Washington D.C: The Movie**

Jacob Johnson, *Arts & Media*

Mentor: Andrew Scahill

### **Abstract:**

One of the most featured characters in American cinema is that of the American Innocent; the ingenue who comes from humble beginnings and makes it big only to discover that they have entered a world they could not possibly hope to understand. This character has many functions, primarily serving as an audience surrogate in the unfamiliar territories of Washington D.C., navigating both the spectator and them through the obstacles of a corrupt political bureaucracy. The American Innocent is best exemplified in characters who exist outside of the sphere of Washington politics, such as Elle Woods in *Legally Blonde 2: Red, White, and Blonde* or Douglass Dillmann in *The Man*, for example, as they are characters who have not been tainted by the political machine and are thus better equipped to challenge the status quo. But rather than simply acknowledge this character's relationship towards Washington D.C. as a political engine, this project will serve to examine the character of the American Innocent and their role in films set in the District of Columbia in a new light. Expanding on work conducted previously on the depiction of the city of Washington D.C. in film, this project will both analyze the features of the American Innocent and redefine the character as a mouthpiece for not just those who are willing to stand up to the jaded politicians and businessmen of D.C. but for those whose experiences the American Innocent represents, namely the Elle Woods' and the Douglass Dillmann's of America. This project strives to redefine this character as an icon of D.C. film, examining its relationship to the city and what it represents, and, more importantly, the purpose of its legacy and how it has built its own meaning over the years.

<https://symposium.foragerone.com/2022-racas/presentations/45489>

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## **Why Serbia Was Successful in Creating the First Yugoslav State and why most other Balkan states failed to expand**

Brandon Stanley, *Social Sciences & Humanities*

Mentor: Greg Whitesides

### **Abstract:**

The Balkans were going to drastic changes during the 19th and early 20th centuries. The decline of the Ottoman Empire and sporadic instances of foreign intervention helped the Ottoman territories in the Balkans become autonomous and eventually independent. After decades of Ottoman domination, many states wanted to stake claims in the territories that their countries controlled prior to Ottoman domination while other states sought to reform the region entirely through forming a federation or staking territorial claims based off ethnicity or national affiliation. Some intellectuals and politicians from Serbia, Croatia, and, to a lesser extent, Bosnia and Slovenia deemed that a Yugoslav (South-Slav) federation would be the best way to successfully move forward in the brave new world of independence. However, the question remains as to why Serbia was ultimately successful in creating a federation. Bulgaria had its own expansionist dreams encompassing Macedonia and the Aegean coast. Greece wished to pursue its irredentist Megali idea to resurrect the defunct Byzantine empire. Even Albania and Romania had expansionist dreams based on either language or history, with only the latter being successful in expanding due to the collapse of the Habsburg empire. In this presentation, I will explain why Serbia was ultimately successful in creating a large, multiethnic, and multinational Balkan state. I will also explain why the Megali Idea failed in Greece, how Bulgaria lost almost all of its post-independence territorial gains, and why Albania was unable to expand.

<https://symposium.foragerone.com/2022-racas/presentations/45460>

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## **Womanhood: The Series**

Ashley Vaughn, Willa Cohn, Margaret McClelland, Brittany Cook, Addison Di Marco, Eric Lopushansky, *Arts & Media*  
Mentor: Jessica McGaugh

### **Abstract:**

“WOMANHOOD: The Series” is a multi-episode original web series created by students and faculty in the Film & Television Department. Each episode is a comedic story regarding a female experience. Episode examples include: menstruation, menopause, workplace disparity, pregnancy, sex, identity, and aging. The project was a recipient of a 2021-2022 UROP award with five students, several alumni, and two faculty members attached.

The purpose of creating “WOMANHOOD: The Series” is to help break the taboos associated with the female experience, allowing a venue for us to share stories related to female bodies and identities. The series gives us an opportunity to laugh at the challenges we face regularly. Our hope is that this project will contribute to more female voices in the media, empowering more women to share their stories.

There are five students that helped in different areas of the production. Brittany worked as Assistant Camera, Margaret worked in Production Design, Ashley worked in Production Design and as a Trailer Editor, Addi worked as Script Supervisor, and Eric worked as a Digital Image Technician and Assistant Editor. “Womanhood: The Series” is a female-driven series both on and off-screen that will positively increase the representation of women on screen. The series features active female leads in all episodes. The characters make decisions, driving narrative storylines themselves rather than being dictated by the choices of male characters.

The outcomes of this project include international screenings (film festivals, digital distribution), long-term industry connections, and contributions to female-identifying voices in the media. Its international presence will bring recognition to the College of Arts and Media, highlighting the high-quality work created by its students and faculty.

<https://symposium.foragerone.com/2022-racas/presentations/45326>

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## **Zoned Out: How does the legacy of extreme zoning policies relate to civic participation?**

Molly McCabe, *Social Sciences & Humanities*

Mentor: Brenden Beck

### **Abstract:**

Municipalities hold great power to regulate land use and often utilize policies to exclude or attract residents. Restrictive density zoning policies, for instance, prohibit multiuse housing. When certain regions are experiencing population growth, anti-density zoning inhibits the housing supply and drives the cost up. The resulting spatial fragmentation perpetuated through such restrictive policies increases economic segregation and decreases civic participation (Oliver 2000). In the United States, the widest of these inequalities is recognized not between metropolitan areas but within them (Drier et al. 2001). Recent research has shown that urban housing markets with higher levels of racial segregation have downzoned to lower density policies from 2003 to 2019 (Pendall et al., 2022). Additionally, past studies have found that population density and population growth directly affect civic participation (Oliver 1999; Carr and Tavares 2014). It is essential to note this relationship because our American democratic project relies on a civil society that strives for pluralistic self-determination. Theoretically, there appears to be an intersection between zoning policy, population density, and civic participation. Although the first comprehensive zoning ordinance was established in 1916, the impacts of such laws have only recently become a popular subject of interest. Broad research has looked at spatial segregation due to zoning policies; however, future research should consider the impacts of such policies on civic participation remains underexplored.

<https://symposium.foragerone.com/2022-racas/presentations/45561>