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COLORADO SPRINGS UNDERGRADUATE RESEARCH FORUM

Saturday, April 9, 2022 | 9:00am–5:00pm

Keynote Speakers

Ken O'Donnell, PhD

Vice Provost at California State University, Dominguez Hills

Robin Scholfield and Jo-Ellen Becco

Faculty and Directors of High Impact Practices | PPCC

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Contents

Oral Session 1

Pages 5-21

Poster Session 1

Pages 22-40

Poster Session 2

Pages 41-58

Oral Session 2

Pages 58-76

Oral Session 1

10:00-11:30 am

Race, Gender & Social Movements Room A217

BBC: Blackness, BDSM, and Community

Irina Amouzou

Tre Wentling

University of Colorado Colorado Springs

Sexuality research has a long history of centering the narratives of white people within the heteropatriarchy. This research broadly investigates Black people's sexual experiences specifically with Bondage and Discipline, Domination and Submission, Sadism and Masochism, also known as BDSM. BDSM spaces resist notions of normative sexual practices and can be spaces for the queering of sex and a resistance to dominant notions about bodies. How do Black BDSM practitioners engage in pleasurable, sensual, and sexual activity in a structurally racist America? Using a snowball method, I reached out to sex centric instagram accounts and Facebook groups, as well as interacting with users on the dating site Feeld, and many emails to sex educators across the country. Through this, I completed 10 semi-structured qualitative interviews with self-identified Black BDSM practitioners from across the U.S. I found that the whiteness of BDSM spaces creates a vacuum of community for self identifying Black people. That not all bodies were allowed to stray too far from dominant norms, and gender identification shapes the experience of race in sexual contexts immensely. This research is significant as Black people's experience of sex are not given platforms to be validated. Not only is BDSM a space marked as devious, but 'Black' is an identity marked as devious. Research such as "BBC", are vital to scholarship about sex, and creates space for more voices in the discourse.

The Persisting Products of Protests

Wedgide Bourdeau
Kelly Piazza
United States Air Force Academy

The inauguration of the Trump administration saw the United States experience a rise in the use of contentious politics surpassing any other presidency since the Cold War. As an illustration, the Black Lives Matter (BLM) protests of 2020 were the largest political movement of the United States history, encompassing widespread and violent manifestations of contentious politics. As social mechanisms for enacting political change, manifestations of contentious politics are a powerful and pervasive sociological force capable of having extensive influence on cooperation and prosocial behavior. As manifestations of contentious politics grow increasingly violent, prevalent, and politically salient, their subsequent effects on social behavior unquestionably merits further study. Using United States public survey data of tendencies towards prosocial attitudes pre and post manifestations of moderate contentious politics within states exposed to the highest quantities of contentious movements, this study demonstrates that exposure to moderate manifestations of contentious politics produces ambiguity in social norms yet increases regional inclination towards prosocial behavior. Extreme manifestations of contentious politics result in more cooperative, prosocial behaviors within in-groups, such as greater desire to engage in volunteer work and increased civic engagement. Exposure to moderate manifestations of contentious politics, such as those experienced during the BLM protests, result in similar outcomes.

Gender Lines in Foreign Policy

Kayla Milford
Dr.Chandler-Garcia
United States Air Force Academy

Within foreign policy around the world, there is a line between general foreign policy and foreign policy regarding gender issues. Foreign policy should combat exclusion caused by the current system that places gender issues separate of broader policy concerns. Specifically, women's health care regarding contraception is a policy that should be viewed as a right rather than a privilege in foreign policy. The implementation of the affordable care act is a policy that is attempting to make women's health a right rather than a privilege through the efforts of the gender policy council. Is the Affordable Care Act the best way to combat gender issues of women's health in the United States and potentially aboard? Analyzing this policy provides for a deeper look into what causes the separation of general and gendered foreign policy and how to improve this policy to further benefit woman.

Challenges in U.S. Foreign Policy Room A221

Mark Johnson Foreign Policy Paper

Mark Johnson
Dr. Lynne Chandler-Garcia
United States Air Force Academy

The countries that pose the most threat to the United States are China, Russia, and North Korea, and they are all an ocean away. Japan, one of the world's most successful democracies and largest economies, is our closest ally in Asia. To maintain proper control of the security threat that Eastern Asia poses, the United States should strengthen its alliance with Japan and focus on policies that allow us to cooperate with them more. Although we currently maintain significant bilateral economic relations and a longstanding Science and Technology Agreement with Japan, these alone are not sufficient to ensure that our mutual adversaries do not overcrowd the region. United States policy should be more focused on enhancing Japan's power dynamic through cooperation in security and diplomatic efforts. We are not using our greatest ally to their fullest potential, which needs to change.

Ethiopia

Jeremy Murphy
Dr Chandler-Garcia
United States Air Force Academy

The United States should increase its humanitarian aid funding and diplomatic relations with Ethiopia due to their fast-growing economy, weak democratic institutions, and ensuring regional security. The US will need to supply more food to millions of Ethiopians and motivate support from the Government of Ethiopians. The building of democracy and a stronger government is at risk of famine and malnutrition in the region.

Quantifying the Economic Impacts of the Chinese Belt and Road Initiative

Austin Moore
Lt Col David Ratliff
United States Air Force Academy

The Chinese Belt and Road initiative, China's trillion dollar infrastructure development project spanning at least 130 nations, has become a divisive issue as it has taken a more prominent role in the public eye; with some parties characterizing it as a scheme to advance Chinese interest and others supporting it as a force to promote growth and prosperity. This discrepancy in characterization raises the question of whether the Belt and Road has an overall positive impact. Using a two way fixed effects regression, macroeconomic data from 195 countries and regions assembled from the World Bank, and contract data

on specific projects from the College of William and Mary, this project seeks to isolate the economic impacts of the Chinese Belt and Road Initiative on trade and economic growth.

A Look into the Signs of Money Laundering

Charles I Maurer
Dr. Gerry Gonzalez
United States Air Force Academy

This paper aims to identify the signals and factors that follow money laundering. Our purpose is to research cases of money laundering and the lessons identified with these cases. Ultimately, we look for events that can point to money laundering in the modern day. We begin by studying some of the biggest money laundering cases, e.g., Ferdinand Marcos, Wachovia Bank laundering scandal, and Iran Contra. Next, we study cybercrimes and laundering through the internet and what those activities look like. Finally, we study the Hawala network and how it operates. We do this to understand why it is hard to regulate and why it is imbedded into the cultures of many countries. We conclude with observations to help uncover money laundering cases in the future.

Literary Lens Room A222

Mr. Darcy: The Character of Hate, Then Love

Brendan Anderson
Daniel Couch
United States Air Force Academy

Jane Austen's Mr. Darcy from *Pride and Prejudice* (1813) is not only beloved by audiences globally, but also represents the archetype of nearly every enemy-turned-lover romance. She accomplished such a feat through careful and formulaic use of free indirect discourse, intentional omission of facts, in addition to allowing the setting to speak to his character. When all of these attributes collide, the novel's remarkable romantic tension becomes apparent. The literary critic Blakey Vermeule provides insight into this topic; her perspective on the use of free indirect discourse argues that it facilitates the misconceptions of Darcy's archetype in order to have the opportunity to reveal his true nature. These exposés are held in reserve by Austen with graceful care to resolve this character's hate with love, leaving the audience satisfied and calmed with their narrative's resolution. It is through this strategy that Austen allows inferences to be made about Darcy based on misinformation, stoking the fires of conflict, and forging the palpable tension that lures both audiences and Elizabeth towards Darcy. It is from this tension that a grandiose reveal of impeccable moral fiber is made that serves to humanize the proud rich man in the eyes of the female protagonist. Ultimately, Darcy's lasting legacy resides in the exploitation of facts to misconstrue the audience's perspective to create conflict, and then in turn to resolve that conflict through revelations found in self-exploration, truthful discourse, and setting. By the end of the novel, the tension builds to a climactic reveal of character and love which makes the resolution all the more satisfying.

Anna Karenina as Vronsky's Frou-Frou: Tolstoy on Relationships

Anna Caldwell
Dr. Mark Kaufman
United States Air Force Academy

Leo Tolstoy's famous adultery narrative, *Anna Karenina*, highlights the excruciating consequences of infidelity, which are prefigured in a short scene at the beginning of Anna and Vronsky's illicit relationship. In my literary analysis of Tolstoy's novel, I uncover parallels between Vronsky's horse race and his love affair with the eponymous protagonist. Through physical similarities, challenges in overcoming obstacles, and eventual death, Anna and Frou-Frou, Vronsky's horse, share an uncanny likeness. Each relationship with Vronsky also serves to expose his dangerously selfish characteristics, which greatly contribute to the ruin of his partners. Ultimately, both pairs fail because they become out of sync with one another, and the final obstacle proves too daunting as Vronsky favors society over those that rely on him. Tolstoy masterfully represents the doomed relationship between Anna and Vronsky in a single scene to represent the fleeting nature of life and the inevitability of the turbulent relationship's end.

Jewish Martyrdom Un-Glorified Through the Akedah in Mr. Mani

Rachel Price
Col Kathleen Harrington
United States Air Force Academy

Jewish culture has been define and divided by the effects of its diaspora for centuries now. This essay moves through the works of A.B. Yehoshua and Orly Castel-Bloom, two widely renowned Israeli authors, to define the Jewish diaspora through the lenses of Ashkenazi and Sephardi experiences. As A.B. Yehoshua wrestles with the culture of Jewish martyrdom, he presents that each Jew's experience of the diaspora leads to a different sense of access to Jewish martyrdom and the blessing it offers. This essay concludes that Sephardic Jews experience an exceptional tragedy as they are excluded from the blessings of the Akedah and thus rejected by the promised-land.

Law

Room A226

Jus ad Bellum in Cyberspace: A New Framework

Brunner, Marc Brunner
Lt Col Timothy Goines
United States Air Force Academy

Cyber weapons have illustrated significant potential for producing significantly deleterious effects. Accordingly, cyberspace has become a warfighting domain in which States may use force against each other. However, jus ad bellum—the conditions under which a state may resort to armed force in international law—provides no explicit guidance on determining when a cyberattack warrants a defensive response, or what such a response would entail. Frameworks, building upon current jus ad bellum standards, have sought to use ethical and policy considerations to create a cyber-specific method for evaluating actions in the domain. This Comment will critique leading approaches before proffering a new model, creating standards for evaluating the principles of just cause and proportionality. A more inclusive and adaptable method for establishing just cause will consider intended effects rather than realized ones, while abandoning a requirement for them to be physically destructive and, instead, creating a provision for intransience. Furthermore, often considered to be unwarranted a cyber-specific evaluation, a new method for approaching proportionality in the domain is proffered. By re-addressing these two principles, a more coherent, flexible, and forward-looking framework for evaluating cyberattacks is created.

Health Care Now:

Why the Due Process Clause Requires the Government to Provide Health Care to Its Citizens

Gish, Nicole Gish
Professor Doug McKechnie, Maj Melissa Ken
United States Air Force Academy

Throughout the twentieth century, the Supreme Court has found that substantive due process rights exist through the Fifth and Fourteenth Amendments. While not explicitly enumerated in the Constitution, substantive due process rights restrict the federal government from infringing upon fundamental liberties. These liberties have been implicitly found by the Supreme Court and are essential in preserving bodily autonomy and personal dignity. Substantive due process rights are traditionally viewed as negative rights and the Court has not found to extend these liberties to positive rights. However, a modern comprehension of positive rights is necessary to ensure the protection of these fundamental guarantees. For citizens to make personal and autonomous decisions, individuals must have the security to pursue their fundamental liberties. This security can only be afforded through the provision of health care. Citizens must receive a certain level of medical care in order to have an opportunity to make decisions regarding personal dignity and bodily autonomy. This paper asserts that the right to health care is a fundamental right implied by the Supreme Court's jurisprudence over the course of the twentieth century, which has repeatedly protected fundamental liberties. In addition to the Court's precedent, the right to health care is a moral right, essential to the preservation of human dignity as established by international

law. International law aids in defining the right to health care and must serve as an auxiliary body for the United States in order to guarantee this right.

Disentangling the Intertwined Fields: The Prevailing Voices of Civil War Popular Literature Impact on New Imaginings of the Equal Protection Clause

Jessica Williams

Prof Douglas B. McKechnie & Dr. Nicole Jerr
United States Air Force Academy

As the Civil War ravaged the United States during the mid-nineteenth century, another two-part war was bubbling, but it involved artists and statesmen: a restructuring of Constitutional law and a revolution in popular literature marked this period. Peculiarly, from this, the later shift in the Supreme Court's Equal Protection Clause leanings are largely in line with popular literature's new imaginings of the role of government. This paper explores the relationship between law and literature through the lens of the Equal Protection Clause of the Constitution as well as the work of Frederick Douglass and Harriet Beecher Stowe. It suggests that the Supreme Court's revamped interpretation of the law, consideration of new voices, and choice of active participation during the Civil Rights Era was possible due to Civil War popular fiction. The paper begins by providing background on the legal and literary conversations during the 1800s, where the Supreme Court remains passive but the literature's argumentative strategies lay the framework for later decisions. It then examines recent political arguments and Supreme Court decisions to demonstrate how the Civil War popular literature anticipated these new interpretations. Ultimately, I posit that Douglass and Stowe's argumentative strategies during the Civil War Era transcended that period to anticipate the Court's broader interpretation of Equal Protection, recognition of its active responsibility, and inclusion of anecdotal and psychological voices.

History Room A253

Charlemagne PP - Pre-Recorded Presentation

James McFadden
Glenn Rohlfing
Pikes Peak Community College

It is essential to understand that Charles the Great (Charlemagne) was the greatest ruler and King that lived in the Middle Ages. Readers will know all about his conquests, challenges, wars, and wins. First, the researcher will dive deeper into his most trusted advisor, Einhard and Alcuin, and explain how their background and knowledge helped them become advisors to Charles the Great—furthermore, explaining if and how that advice helps or hinders the King in certain situations in becoming a powerhouse of a King. Finally, the researcher will explore the very roles of Charlemagne, other than the ruler of King, ruler, father, and husband, paying some attention to the Missi Dominici.

Medicine of the Middle Ages: The Implications of al-Rāzī

Giles, Christen Giles
Glenn Rohlfing
Pikes Peak Community College

The world's medical advancements are widely controversial and unknown due to most medical findings being lost in translation. Science and medicine went through a drastic change thanks to the Muslim "father of medicine" Abū Bakr Muḥammad Zakariyyā al-Rāzī. Rhazes held influential insight into the medical field and led to the determination and differentiation of some conditions we know of today such as smallpox and measles. Between approximately 865-925, Rhazes made extraordinary discoveries throughout Persia and all of the Middle East by studying from Greek physicians before him. People such as Galen and Hippocrates are some of the few people Rhazes expanded his knowledge from. Although most of his works were in Hebrew and Arabic, copies that were once lost have now resurfaced and have been translated into Latin, English, Spanish, and French. Despite his work being lost for thousands of years, Rhazes' legacy still lives on through the delicate art of medicine.

Contraband Camps of the Civil War: How the United States Government Became a Slave Holder

Niki Collings
Barbara Headle
University of Colorado Colorado Springs

There is no lack of scholarship in the study of the Civil War. So voluminous are the books, articles, podcasts, and documentaries that lay readers count themselves as well-versed on the subject. Ask anyone

who has even a passing knowledge of the Civil War what the Gettysburg Address is or who Robert E. Lee was, and they will reply with the essential facts. However, ask them what contraband camps were and the replies are usually blank stares. This is not surprising; it is, however, ironic that in the study of a war waged to free enslaved African Americans, such a gap exists, for contraband camps reveal much about the lived experiences of the enslaved as well as the federal government's policies regarding those they were charged to protect and assist. Examining Civil War contraband camps provides much needed insights in Civil War and Slave histories that are otherwise largely ignored. Why are contraband camps not more widely researched and part of the public's bank of Civil War knowledge? Because, in part, acknowledging contraband camps and the government's role in becoming a slave holder conflicts with the American exceptionalism view of the country's history. These camps conflict with the mythology that the Union was staunchly anti-slavery and as soon as fugitive slaves found their way to Union lines they were miraculously and immediately granted their freedom. This research seeks to demonstrate that rather than finding freedom in contraband camps, fugitive slaves became little more than the property of the Union government. Here, the dualistic approach—social and government—to the study of Civil War and Slave history emphasizes contraband camps as a site of analysis and shifts the focus from the Civil War as an event to the black lives that were affected by the war.

Mental Health Fundamentals Room A255

CAM Therapy Options for Mental Disorders - *Virtual Presentation*

Anique Herbst
Robin Schofield
Pikes Peak Community College

Life for many involves the increasingly complex need to navigate the social structure of our society. While many people are able to adjust and adapt to life in the context of societal expectations, many find themselves struggling to navigate day to day function in every day life. Those struggling with mental disorders are given guidance towards the standard accepted methods for treatment such as medication, talk therapy, and hope. These common standards are the same regardless of age, gender, and experience. While there are some who find solace in their ability to manage their symptoms with medication and talk therapy, many struggle to find consistency and simply lack the desire to allow medicine to manipulate them into "normal". Research needs to be explored as we search for healthy complimentary alternative methods. While some studies do exist and have provided the research and proof needed to suggest alternative options such as yoga, tai chi, meditation, and other mind-body equivalents, there is much to be discovered. The question around which therapies are appropriate to use for which mental disorders still needs to be narrowed down. It is important to start small and expand the research because there are over one hundred Complimentary Alternative Medicine therapy options to date. Every human has basic functions such as diet, movement, and routine. These three can be explored and expounded on over time

as we research their effects on mental disorders. Adults, adolescents, and children alike have a need for research to explore the benefits of alternative options when they are struggling to adhere to current methods.

How did households and businesses financially adapt to public health regulations during the COVID-19 pandemic?

Marianna Jaques
Warren Munick
Pikes Peak Community College

Rather than dictating if an individual must or must not get vaccinated, this project will focus on the economic impact of vaccine hesitancy and public health restrictions on households and businesses. The problem statement is as follows: How did business and households financially adapt to public health regulations during the pandemic? Additionally, the concern focuses on how they can adapt to the post-pandemic economy considering that unemployment hit 14.7% in 2020, its highest level since the Great Depression (Insider, 2020). Economically, this means that businesses and households faced a decrease in consumer spending and demand. Getting into more depth, this research will also evaluate local organizations and resources available to support businesses during this crisis. For instance, these organizations' goods and services, and target audience, will be taken into consideration within the main topic of the project. Finally, the reason for this ongoing case study falls under my Principle of Economics class given by Warren Munick at Pikes Peak Community College.

Creating Analytical Tools Capturing Fundamental Causes of Black Maternal Mortality: To Be Used By Maternal Mortality Review Committees

Ceilidh Shea
Elizabeth Coggins
Colorado College

The risk of maternal mortality in the United States is much higher than nations with similar wealth, access to care, and infrastructure. However, increasing risk of maternal mortality is not distributed equally; Black mothers are three to four times more likely to die of pregnancy related conditions or causes than their White counterparts. Leading to the question, why are Black women predisposed to greater risk? It is not biology. So, what is it about being Black in the United States that has come to shape disparities in pregnancy related death (and nearly all other major disease outcomes)? This thesis will explore the preconditions of Black maternal mortality, developing two tools to capture fundamental causes: the Geography Index Score and the Maternal Perspectives Form. The hope is that these tools might be used to assess the causes of a maternal death and therefore will expose the fundamental causes of Black maternal mortality. Ultimately, by providing a multi-layered framework for determining a cause of death, the Geography Index Score and Maternal Perspectives Form will reflect geography and social determinants of health as informed by anti-Black social and political structures, while also exposing the interpersonal and obstetric racism experienced by Black mothers in medical settings and over the course

of their lives. By including these tools in the review of maternal deaths, recommendations and legislation for prevention of Black maternal mortality will be reflective of its true fundamental causes.

Campus Safety in Relation to Alcohol Abuse - *Virtual Presentation*

JenniferLorenz

Robin Schofield

Pikes Peak Community College

The college journey can be one filled with obstacles and rewards. One prominent issue many students and parents may overlook is that of campus safety. There are concerning statistics in relation to the type of post-secondary education facilities and the crime committed therein. Institutions receiving federal student aid are required under the Clery Laws to timely and adequately report incidents of crime on their campuses and public owned spaces such as bus stops and parking lots. The numbers amongst local colleges and universities are startling as the only decrease in reported incidents such as rape, occurred during a pandemic. While local police work closely with campus police/security agencies, the resulting prosecution surrounding these crimes is unknown. Several actions can be taken by campus administrators to increase safety however, parents and students must stay particularly vigilant in reviewing published statistics, interviewing campus police in regard to safety measures, attending offered educational programs, and keeping open communication revolving around the potential risks and dangers of drug and alcohol abuse.

Poetry Readings
Room A259

El relámpago

Eric Miller

Dr. Ismênia Sales de Souza
United States Air Force Academy

A Perspectiva É Tudo

Amir Walker

Dr. Ismênia Sales de Souza
United States Air Force Academy

Movimiento

Nathaniel Kolligs

Dr. Ismênia Sales de Souza
United States Air Force Academy

La contradicción” y “La lotería

Andrew Hootman

Dr. Ismênia Sales de Souza
United States Air Force Academy

Miles de Millas

Aidan Boyle

Dr. Ismênia Sales de Souza
United States Air Force Academy

La poesía de la vida

Fernando Robalino

Dr. Ismênia Sales de Souza
United States Air Force Academy

Se o Mundo Acabasse Amanhã

Micah Larkin

Dr. Ismênia Sales de Souza
United States Air Force Academy

U.S. Social Issues & Landscape

Room A260a

The Eugenic Connection: The Success of the Human Betterment Foundation in the 21st Century

Stacey Stone
Dr. Carole Woodall
University of Colorado Colorado Springs

In 2001, Kelli Dillon, while incarcerated in the California Department of Corrections and Rehabilitation (CDCR), only 24 at the time, was sterilized without her consent and without her knowledge. Dillon became the first survivor of sterilization abuse to sue the California Department of Corrections and Rehabilitation for damages. In July 2013, an exposé by Corey G. Johnson and the Center for Investigative Reporting, revealed that between 2006 and 2010, 150 female inmates had been sterilized without the required state approvals, and that another hundred could be traced back to 1990 through state documents and oral accounts. A 2022 report “Forced Sterilization of Disabled People in the United States” from the National Women’s Law Center in Washington D.C., found that thirty-one states, in addition to Washington D.C., still have laws that allow for the use of forced sterilization. The report also revealed that new forced sterilization legislation was passed in Iowa and Nevada as recently as 2019. The longevity of eugenics laws into the 21st century is due in large part to the work of eugenic organizations from a century ago, such as the Human Betterment Foundation. My presentation examines the Human Betterment Foundation (HBF), the members, activities, and publications to further understand the role of the foundation in spreading propaganda, which advocated for additional legislation to support eugenics-based compulsory sterilizations to the public. My work contributes to understanding the role that the activities and publications of the HBF had in perpetuating the longevity and pervasiveness of eugenic based compulsory sterilization programs and legislation in California.

Reactionary or Intentional

Sarah Wright
Professor Gary Walker, Coach Christine Green
Pikes Peak Community College

Generational history is important to understanding America’s present standing in the world. The greatest and silent generations grew up during world wars and economic instability and are known for being resourceful with unrelenting values, which is interesting when considering that their children, the baby boomers, led the hippie movement championing free love and sexual expression. In the 80s and 90s, there was a movement of people who witnessed the devastation of the hippie movement and wanted to raise their children opposite by enforcing strict abstinence only before marriage. Many millennials who grew up in what is now known as “purity culture” experienced forms of abuse, sexual repression, and dysfunction. Doing the opposite did not produce the desired outcome. Imbalance is everywhere. Commercials where the options are either a diet plan or all you can eat at restaurants. Work/school weeks for kids and adults are 5 days on, 2 days off. Russia has even been linked to social media accounts promoting opposite opinions to both the right- and left-wing political parties. We cannot fight a problem

we do not understand. Americans need to seek to understand history and start making small intentional adjustments that will eventually lead to positive changes.

Modernizing Pikes Peak Region Data with ArcGIS Capabilities

Gina Galjour, Rachel Johnson
Matt Gottfried
University of Colorado Colorado Springs

El Paso, Teller, and Fremont County are collectively growing counties in the Pikes Peak Region. In partnership with the Pikes Peak Outdoor Recreation Alliance (PPORA) and NES Landscape Architects, we created and designed a data dashboard showcasing Arc GIS Online capabilities for the outdoor recreation economy of a three-county region. The purpose of the data dashboard is to communicate outdoor-related information to the public and community leaders of the Pikes Peak region for better understanding, recognition of value, and thoughtful fact-based decision-making. The dashboard displays useful and creative spatial and tabular data on socioeconomic, recreation and tourism, and natural resource data.

U.S. Ecosystem - *Virtual Presentations* Room A261

Sustainable water

Tyler Ury
Robin Schofield
Pikes Peak Community College

Springs. One thing that I hope to discover while doing this research project is that Colorado Springs has a plan in place so that we have a way to build up our water supply and so that way we dont run out in the future. Some sources that I have found is a projection of the amount of precipitation we get from CU, Colorado Springs Utilities has something on their website that tells us plans they have for the City of Colorado Springs, and epa.gov has something that talks to us about saving water in Colorado. Something that I still want to find for my sources is something that tells us that we are in trouble and need to find a way to make things work.

Wolves and the betterment of the ecosystem

John Fowler
Robin Schofield
Pikes Peak Community College

The gray wolf has been apart of the American frontier for hundreds of years. Colonist from Europe feared the European wolf that they posted bounties for all wolves in America. Four hundred years later the wolf was on the danger of becoming extinct in North America. The colonists didn't understand the part that the wolf plays in a healthy ecosystem. With the development of modern ecological studies, we have a better understanding of the role the wolf plays for the ecosystem. Looking at Yellowstone National Park, the reintroduction of the wolf plays a much larger role than people realize. Wolves are a social, pack animal, that aids herd control of herbivores such as elk and moose. There are presently multiple groups working towards the reintroduction of the wolf in multiple states of the United States. Whilst there is also the opposite who would rather not see wolves return to their natural range. Ultimately, we must do what is right for the ecosystem, and wolves truly do help develop a healthy ecosystem.

Child Development Center or Daycare

Rajju Thapa-Dangol
Robin Schofield
Pikes Peak Community College

Traditionally, children attend child development center or daycare to gain some early childhood education before they enter kindergarten. Some of them are compelled to go to daycare before they turn one because of certain circumstances like both parents are working, low-income families, and single parents. My interest in daycare arouse because of the incidents people have been facing in past years. We all are aware of the vision parents have about daycare: a place where their children can be safe and secure, surrounded by a healthy environment while they are working hard to meet their needs. Not all parents are lucky; some face great tragedy after leaving the child at the daycare. Some of the parents are not even aware if the daycare is licensed or unlicensed. Because of how expensive the daycare is, they ended up randomly choosing the cheapest daycare. There are many issues to explore, like are daycares reliable, in what ways are daycare helping children develop, are the people involved in taking care of the children at a certain program fully trained, are they CPR/first-aid certified, what can be done to completely get rid of unlicensed daycare and many more. The focus and purpose of this research paper is for all those innocent children and the trust of parents, who put their children at daycare without even knowing what can happen to them in just a blink of an eye.

Colorado's Hidden Histories

Room C200

Building Storymaps for an Inclusive History of Colorado

Hazel Key
Dr. Kimbra Smith
University of Colorado Colorado Springs

My work with Dr. Smith has centered around creating accessible ways for students to thoughtfully engage with their local communities and the history of Colorado. The white colonial narratives we are taught in school do not reflect the ethnically and racially diverse histories our country is constructed of, demonstrating that who is included in history is an intentional privilege. What happened in the past dictates the sociocultural dynamics of the present- everyone should be able to see themselves in history as well as learn about their own heritage. To remedy this, we will have to alter whose stories are seen as a legitimate part of national narrative by giving students the tools to pursue their own research. For my own project, I have created an ArcGIS Storymap on the history of the Ute nation's history in Colorado titled, *The Privilege of Home*. Colorado Springs is now inhabited by people from a variety of backgrounds and ethnicities, but it belonged to the Utes first and foremost. Few textbooks go in depth on the cultural influence the Utes have on the western United States, the ways in which they have been systemically oppressed, or that they are even still alive and well today. I have created a second storymap to be presented alongside *The Privilege of Home* at CSERF, showing the value ArcGIS storymaps have as a free educational tool, and offering guidance for others on how to create their own. By encouraging students to pursue their own local histories with curiosity, giving them a platform to creativity express their research, we can all learn to empathetically understand the past's impact on our personal lives today, and share the importance to inclusive histories.

Foster Care System- 18+ After Care – *Virtual Presentation*

Taiya Hicks
Robin Schofield
Pikes Peak Community College

The El Paso County foster care system has an overwhelming number of children in the system. In December of 2020, the El Paso County foster care system has approximately 700 who are in out-of-home care. The system isn't perfect and the children who are aging out of the system get overlooked. For most kids turning 18 is exciting, you are finally an adult. For foster children that means they must get a job, start shopping for themselves, and find a place to live, unlike their peers who can still live at home and receive their parents' support. In the year 2020 the number of homeless youths was approximately 320-370 that year, it varied from month to month. The article, "Need for foster care families across El Paso County persists" written by Breanna Jent talks about how children who age out of the system find a temporary place to stay, but they can quickly overstay their welcome, and that can result in living in their cars or on the streets. How can we create better programs for teenagers who don't have guidance for adulthood?

**Jesuits, Hispanos, and the Oldest Church in Colorado:
A Forgotten Tale of Settlement in the American Southwest**

Javier Cantu
Santiago Guerra and Jane Murphy
Colorado College

The religious and political history of the San Luis Valley is tied to ideas of distinctive cultural patterns shaped by isolation, rough frontier conditions, and economic and political problems quite different than those faced in New Mexico. Yet seldom we are reminded of the importance of the history of the northward expansion of Hispanic peoples and institutions—of the true extent of its reach and influence in shaping American society as we know it. Former U.S. Secretary to the interior, Ken Salazar states: “The history of Spanish and Mexican descendants of Southern Colorado has been a forgotten history.” He adds, “In schools in the [San Luis Valley], no one ever taught the history of the northward migration of New Mexicans into Southern Colorado.” This study arises from Salazar’s analysis: A need to re-visit, re-frame and re-evaluate historical knowledge in popular discourse and academic curricula. The story of settlement in the San Luis Valley in Southern Colorado is the tale of the last known deliberate colonizing movement by Hispano peoples. The Valley, also the setting of the Jesuit Residence of the first church in Colorado, Our Lady of Guadalupe, was once part of the northernmost frontier of Spain’s colonial empire, and later the Mexican Republic. The first people to establish successful settlements there were able to do so until the middle of the 19th century, due in part to Spanish and Mexican Land Grants issued during the Mexican period, as well as various treaties that gave the United States permission to build military forts. In light of bringing attention to ‘forgotten histories’ that do not make it to popular narratives of the U.S. West, the study will explore these unique cultural, economic, and political dimensions that shape the history of religion, settlement, and community building in the San Luis Valley.

Poster Session 1

10:00-11:30 am

Synthesis, Separation, and Characterization of the Distal and Proximal Isomers of a New Ruthenium Complex, [Ru(dpop')(3,6-bis(2'-pyridyl)pyridazine)Cl](PF6)2

Sarah Aragon
Dr. Ronald Ruminski
University of Colorado Colorado Springs

Isomers of [Ru(dpop')(3,6-bis(2'-pyridyl)pyridazine)Cl](PF6)2, were synthesized and characterized by UV-Vis electronic absorption spectroscopy, cyclic voltammetry, mass spectroscopy, and NMR spectroscopy. The proximal and distal isomers were separated on an alumina column as confirmed by their 1H and 2D-COSY NMR spectra, and GS-MS results. Ruthenium d(π) \rightarrow ligand(π^*) metal to ligand charge transfer transitions were observed in the visible region of the spectrum while more intense intraligand transitions were observed in the UV region. The electrochemical analysis further supported the presence of the synthesized molecules.

The Effects of Value on Children's Learning Strategies

Grai Calabro
Diana Selmeczy
University of Colorado Colorado Springs

The ability to prioritize remembering information that is more important or valuable (e.g., a family member's birthday) while inhibiting less valuable information (e.g., a friend's birthday) is called value-based remembering (Knowlton & Castel, 2021). Although adults are able to engage in value-based remembering, we have limited knowledge on the development of this process in children. The current study examined the development of value-based remembering in children between the ages of 6-7 and 9-10. Children studied items worth 1 or 10 points for a memory test. Our results showed that children engaged in value-based remembering and were more likely to remember high versus low value items. Critically, value-based remembering improved with age and was only present when items were studied multiple times. Overall, these results suggest that there are developmental improvements in value-based remembering and this ability may only emerge under certain contexts. The results of this study contribute to our understanding of the development of learning strategies with potential implications for academic classroom settings.

**The Better Side of Herbicide:
Developing a Rapid Method to Identify Transformed Wisconsin Fast Plants**

Annaliese Calzadilla
Dr. Amy Klocko
University of Colorado Colorado Springs

Everyday 25,000 people die from hunger related causes. A fruitful option to obtaining healthier crops is to genetically modify plants with the ability to be more nutritious and resistant herbicides. A reliable and quick transformation is important for Brassica rapa, aka Wisconsin fast plants, as it increases its usefulness as a model plant and teaching subject. Current procedures allow 1 in 1000 seeds to be transformed. Finding transformants is limited to screening for physical changes that may show in seedlings. Identification of the transformed seedlings could be speed up with a robust herbicide selectable marker. This study intends to make a streamlined methodology that allows students to follow. We use Agrobacterium tumefaciens for transformation via a floral dip procedure. We will be inserting a gene to allow the plants to express Green Fluorescent Protein (GFP) along with resistance to herbicide. The purpose of GFP is two-fold, causing an interesting reaction to captivate students and adding another visual marker for identifying transformed plants as they are grown on media-infused herbicide for selection. Currently, we have determined a sterilization procedure to be used on the seeds and herbicides that are effective. We also performed two experimental rounds to develop transformed Brassica rapa. Overall, we collected 4777 seeds. Of these, 447 seeds were plated and believe 161 to be transformed, an overall efficiency of 36%. Future plans include growing potential transformants for genotype testing, evaluating remaining seeds, and having students test the floral dip procedure as part of a lab class.

Raciolinguistics, Racial Matching, and White Woman Educators

Colleen Campbell
Dr. Mike Taber
Colorado College

This preliminary study seeks to examine the relationship between raciolinguistics and racial matching in elementary school classrooms. Raciolinguistics is a theory that describes the historical and contemporary co-naturalization of racial and linguistic categories, seeking to surface relations between language, power, and race through many different societal conditions. Racial matching, a theory that was first presented in response to the overrepresentation of white educators in classrooms with majority BIPOC students, is the theory that students of color achieve higher academic success and are disciplined more fairly and equitably in classrooms that are run by teachers of color. This preliminary study employed a raciolinguistic framework to explore the overrepresentation of white woman educators in public elementary schools, thinking specifically about the implications for student assessments and the development of racial and linguistic categories. Qualitatively, a critical discourse analysis of linguistic assessments' websites yielded themes including but not limited to empiricism and standardization that highlight the racial and linguistic biases of these assessments. Quantitatively, iStation assessment scores of 127 kindergarten through third grade students at a public elementary school in Denver, Colorado were analyzed. The selected school featured a student body that was 76% Latinx and a teaching staff that was 89% white, indicative of racial mismatch. Cross analysis of test scores and student demographics revealed that racial mismatch leads to

reduction in tested student linguistic proficiency. Results align with the existing body of literature which posits that racial matching can increase the academic and personal success of students of color. Future research involving larger sample sizes and observational or interview-based qualitative methods could be conducted to further support these preliminary findings and explore the relationship between raciolinguistics and racial matching more extensively.

Characterization of a Fourth-Generation Event-Based Neuromorphic Sensor

Liam Champagne, Kaylee King
Major Daniel O’Keefe, Dr. Matthew McHarg
United States Air Force Academy

This research focuses on investigating the potential of leveraging a high speed and low data rate neuromorphic sensor for space weather and national defense applications. Space-based imaging currently relies on the traditional method of reading out an entire focal plane array at a fixed cadence. Due to size, weight, power, and data constraints for space-based capabilities, relying on this traditional imaging methodology typically requires careful management of a challenging trade space of cost and technical performance (e.g. spatial resolution and temporal resolution). By utilizing neuromorphic (i.e. event-based sensors), which independently record only changes in scene brightness on a pixel-by-pixel basis, many of these limitations can be overcome. Additionally, neuromorphic sensors have high dynamic ranges, suitable for scenes containing both bright and dim objects common to space environments. As a follow-on to analyzing data from our first-generation neuromorphic sensor aboard the International Space Station, we are characterizing a fourth-generation neuromorphic sensor to prepare for spaceflight in 2024. The fourth-generation sensor used in this study boasts a 20-fold increase in the number of pixels, a 100-fold increase in throughput, and a dramatic decrease in noise over the first-generation sensor. To prepare this new sensor for space, we begin with an initial sensor characterization: validating its throughput, measuring its frequency response, and exploring how various bias settings impact its sensitivity to different event types. Afterwards, we test the sensor using computer-simulated events and in the detection and tracking of satellites. These early tests improve our familiarity and understanding of the fourth-generation neuromorphic sensor’s use, capabilities, and limitations, findings which will be leveraged when employing this sensor from space to observe lightning, sprites, and other high-altitude phenomenon.

Using a Model Based Enterprise to Improve NASA Facility Maintenance Operations

James Chitika, Ryan Cramer, Jared Dove
Lt Col Brian Lemay, Lt Col Jeffrey Newcamp
United States Air Force Academy

It’s been 52 years since NASA has put a human on the moon, so their aging facilities require significant maintenance to do it again. However it is unclear how to prioritize the maintenance schedule given NASA’s limited budget. We develop and analyze a model that is based on synthetic data that closely resembles a subsystem that could be found in one of NASA’s facilities in order to answer the research question of “How can NASA streamline their facility maintenance operations?” We perform quantitative data analysis to examine what factors in the subsystem predict system failure in terms of operability. This information

is used to build a model that will ultimately assist NASA in reducing the facility maintenance cost by identifying ahead of time when its subsystems will fail. This model informs the decisions of facility managers at NASA to ensure that their facility is assisting in meeting NASA's goal of returning to the moon while not wasting its budget on poor maintenance scheduling practices.

Autonomous Rover via Reinforced Behavioral Learning

Weston Corbeil, Mason Utt , Tanner Todd
Chad Mello
United States Air Force Academy

Our goal is to build a reinforcement learning (RL) package capable of training ground-based autonomous rovers for navigation and mission completion within a variety of environments. We are training in the physical environment, as opposed to virtual environments; this approach is typically constrained by the amount of time it takes to train machine learning (ML) models. We cannot speed up episodes or train in multiple parallel environments in comparison to typical approaches that use virtual environments. Convergence of our RL models while running physical sessions would be nearly impossible using a randomized ML model. Therefore, we combine a pre-trained behavioral cloning model with the Advantage Actor-Critic (A2C) RL approach to significantly reduce the time it takes to train our models in a physical environment. We use dueling networks to converge on some optimum for training a ground-based rover. The actor neural network is our policy network, and is essentially a modified, pre-trained behavioral cloning model (Bojarski CNN) that yields throttle and steering mixture values for our skid steer rover; it yields the actions the rover should take in any state. The state consists of camera images and depth sensor data. The critic uses the same model as the actor. Its output layer and optimizer are modified render the reward "value" of a given state. The goal of this approach is for our two networks to work together to learn a policy that the rover executes against that maximizes its rewards (via the critic model) as well as minimizes the overall loss function (mean squared error). In the end, we have a cheap tech stack with a small footprint able to learn missions in the physical world despite the inherent problems.

Air Force Reserve 15A Billet Optimization

Zach Couper, Taylor Markham, Luke Nolley, Brad Owens
Dr. Dulin, Lt Col Miller
United States Air Force Academy

This project focuses on the recent shift in the Air Force Reserves operations research career field (15A) from primarily supporting acquisition functions to focusing on operations. The team analyzed the Air Force Reserves' 15A billets authorizations. Following Air Force Reserve leadership guidance, the team aimed to align the missions and locations of the Air Forces Reserves with that of the active duty 15A career field. Using the statistical software and surveying 15A reservists, the team analyzed the billets by calculating the percent difference of mission type and location between the reserves and active duty. Reserve billets that differed from active duty billets were given a higher score, indicating a greater need to change/restructure that billet. Types of mission were also taken into account. Billets supporting an

operational mission were classified as more essential and thus there is a less of a need to move them. Survey responses were used to gauge the impact of certain billets and their necessity given the restructuring of the career field. The project team was then able to rank which Air Force Reserves' 15A billets should be moved/restructured to meet the current refocus of the career field.

Confirming Gene Regulation/Expression Modulation as Markers for SARS-CoV2 Infection

Cruz, Antonio
Dr. James J Steel
United States Air Force Academy

SARS-CoV2 infects the respiratory tract of humans, resulting in COVID-19. During infection, the virus takes over the host cell and can result in drastic changes to gene expression. It has been proposed that host cell gene expression modulation may serve as an accurate diagnostic and correlation to SARS-CoV2 infection. We selected six genes (IGKC, DOK-3, IFIT1, HOXA10, MADCAM1, and MIR1-1HG-AS1) and tested them to monitor how SARS-CoV2 infection altered their expression, as compared to uninfected samples. Gene-specific primers were designed for PCR amplification and qPCR detection for our six gene targets. Preliminary findings confirmed the results that IGKC, DOK-3, and IFIT1 experienced up-regulated gene expression during COVID-19 and MADCAM1 exhibited a down-regulated pattern during COVID-19 infection. Host cell gene modulation may serve as an earlier detection and confirmation system to diagnose COVID-19 infection instead of waiting for SARS-CoV2 RNA levels to reach high enough abundance for detection. Further work will investigate the role of these genes and potentially look at how changes to gene expression may correlate with disease outcome in patients. Confirming the gene expression in the presence of SARS-CoV2 allows for a more accurate and subtle system in isolating the infected individuals and withdrawing them from the population to limit the spread of infection amongst others. Additionally, this overall enhances our understanding of basic virology and cell biology by answering the question of why specific genes are turned on or off in the presence of COVID-19.

Improving Inpatient Discharge Processes in Hospitals

Kyle Dane, Staci Davis, Tim Perea, Eddie Ro
Dr. Johnathon Dulin, Lt Col John Miller, and Lt Col Brian Lemay
United States Air Force Academy

As the fear resulting from the Coronavirus outbreak declines, willingness to visit hospitals for non-pandemic related health problems has grown, so hospitals are getting increasingly busy. To get new patients the care they need, beds must be available; reducing the time it takes to discharge patients drives this availability. Through clinical observation, we identified multiple processes causing delays in patient discharge time. We then used data collected from the hospital to quantifiably explain the effects of these delays and determine how changes in these processes could decrease discharge time. Some of the processes found to cause the most delays were communication between floors, availability of patient transportation, and task saturation of staff.

Campus Race to Zero Waste: Game-Day Basketball Recycling at USAFA

Shahana Gray, Boreth Pech, Morgan Ustick, Justin Wilmoth
Dr. Amelie Davis, Ms. Daniela Lawrence
United States Air Force Academy

Campus Race to Zero Waste is a competition among colleges and universities across the United States that aims to promote recycling. The United States Air Force Academy (USAFA) competed in the game day basketball category, where the goal is to collect the largest amount of recycling per capita at a single game. We also wanted to greatly reduce or try to eliminate contamination of the recycling waste stream given disposing non-recyclable items in recycling bins often leads to that collection being sent to the landfill. We conducted an experiment to answer the following research question: how does the location of the recycling bins in relation to the trash bins affect people's ability to recycle properly? Half the trash-recycling bin pairs in the basketball arena were placed directly next to each other; the other half were placed five meters apart from each other on either side of a walkway. We hypothesized that placing the trash and recycling bins five meters apart from each other will result in more contamination. We counted instances of attempts to recycle properly and improperly during half time and through the second half of the USAFA versus NM Lobos February 5 2022 men's basketball game. Overall, when the bins were placed together, more people attempted to recycle compared to when the bins were placed apart (237 instances versus 76 instances, respectively.) Interestingly, 25% of people placed a non-recyclable item in a recycling bin when the bins were part, while 32% did so when the bins were placed together. The percentage of contamination attempts however did not differ statistically between the two treatments ($\chi^2(1, N=13)=0.91, p=0.34$). We do find that the location of bins matters and that abutting the recycling and trash bins yields more recycling attempts, but education and signage are greatly needed to reduce contamination rates.

Internet of Things Lightweight Encryption Evaluation

William Duran, Bryson Fraelich, Andrew Lee, Augustin Sullivan
Major Bobby Bierer
United States Air Force Academy

Internet of things (IOT) devices with limited processing power and memory have introduced significant security vulnerabilities and challenges. These systems often sacrifice critical security features such as encryption due to the high demand these features would place on the system. To address this issue, NIST (National Institute of Standards and Technology) published a call for new lightweight symmetric encryption techniques for use with embedded devices such as IOT devices. These lightweight techniques would require significantly fewer resources than traditional encryption mechanisms such as AES, allowing them to be used on even the most constrained devices. From the 56 original submissions, 10 algorithms were chosen as finalists to be evaluated for their overall security and performance impacts. This study tested the performance of Ascon, one of the algorithm finalists on IOT devices. The study measured the performance of Ascon on real-world systems, including a weather station and e-ink display. These measurements included CPU usage, RAM usage, power consumption and packet captures of the communications traffic. The results of these measurements confirmed that Ascon performs well in resource-limited systems and would add much-needed security to IOT devices.

Our Homeless Epidemic

Jessica Edwards
Robin Schofield

Pikes Peak Community College

I am going to be researching the rise of homelessness in the past 10 years in Colorado and the impact that it has on our environment. Upon beginning my research, I have learned a lot about how this impacts our environment, as well as what it is like to be homeless. It is seemingly difficult to find definitive solutions to this ongoing problem. There are a few solutions that have been used such as housing programs and shelters, and those come with extensive cons. Going forward I would like to see if I can find any solutions that have been effective and will be used in the future. Sources such as the City of Colorado Springs website, as well as Denver-Metro area journals, have a lot of information about homelessness in specific areas that are local and well known by natives. I have also used the National Low-Income Coalition; they are an organization that provides housing to the lowest income of our population. This has taught me the impact on our Environment and our Criminal Justice System because of the rise of the homeless population. Southeast Express is an article used that mentions the homeless impact on the southeast not just Colorado. Using this knowledge from other states, it can help combat ideas to solve the problem locally.

Predicting Demand and Optimizing Construction of Affordable Housing: An Analysis for the City of Cheyenne, Wyoming

Grant Engel, Matthew Guevara, Lindsey Lucas, Payton Wilson
Lt Col Adam Ackerman, Lt Col Brian Lemay, and Lt Col Anne Portlock
United States Air Force Academy

The purpose of this paper is to determine strategies for managing affordable housing shortages; specifically, we focus our efforts on the city of Cheyenne, Wyoming. Population growth associated with the new Ground Based Strategic Deterrent (GBSD) program, at FE Warren Air Force Base may proliferate the existing shortage of affordable housing in Cheyenne. Using census data and our own research and interviews with city personnel, we not only model future housing demand to understand the extent of the problem, but we also model how new construction, expanded rent assistance, and improved public transportation options may help address the problem. We predict the current and future population growth and demands of affordable housing in the city and identify a variety of opportunities to mitigate the impacts of the housing crisis to include renovating current rental units and revising public programs like transportation and financial housing assistance.

Silicon Laser Spectroscopy and Cooling for the Construction of a Quantum Computer

Noah Everett, Carson McLaughlin
Dr. Jerry Sell, Dr. Alina Gearba, Captain Anita Dunsmore, Dr. Randy Knize
United States Air Force Academy

We are in the preliminary stages of constructing a silicon-based quantum computer. Using a 252 nm laser and a silicon atomic beam, we perform laser spectroscopy of the $3s^2 3p^2 \ ^3P_1 \rightarrow 3s^2 3p 4s \ ^3P_0$ transition to measure the hyperfine structure and calculate the isotope shift between Si, ^{28}Si , and ^{29}Si . We use these measurements to design a Zeeman slower which laser cools and traps Si.

The Detection and Generalization of Quaternary Amines by Canine Olfaction

Ciara Gavin
Kristin Rowan
Pikes Peak Community College

For decades, canines have been used to detect classes of chemical compounds, such as the nitrogen or chlorine compounds found in bombs. As anaphylactic reactions increase worldwide, allergies to the class of compounds known as quaternary amines have developed. Quaternary amines are permanently positively charged molecules derived from ammonium, and may have any or all of the hydrogen atoms replaced by alkyl or aryl groups. They are surface-active agents used primarily as disinfectants and cleaning products. This research attempted to discover if dogs could be trained to detect specific quaternary amines, and if so, whether or not they would spontaneously alert to other types of quaternary amines they were not specifically trained to detect, a skill known as generalization. Generalization indicates that some detectable fragment of the odor remains the same between the molecules, despite the structure changing. If canines are able to generalize between quaternary amines, they may be used to alert allergic individuals to the presence of quaternary amines in an area. Initial research indicates that canines can detect and alert to specifically trained quaternary amines, but no generalization between compounds has yet been observed.

Development and Characterization of Perfluoropyridine Pendant Polymers

Ian Geniza
Abby R. Jennings
United States Air Force Academy

Fluorinated polymers remain of interest due to their implementation in high performance applications, such as the aerospace and automotive industries. Recently, our group and others have shown that perfluoropyridine (PFPy) can be utilized to make fluorinated polymers and materials. In this work, a new PFPy containing monomer was synthesized via nucleophilic aromatic substitution. The monomer was then combined in varying mass ratios with methyl methacrylate and co-polymers were prepared via radical initiated chain growth polymerization techniques. The resulting polymers were characterized using TGA, DSC, GPC, and multinuclear NMR spectroscopy. The results of these studies will be further discussed.

Machine Learning Applications for Synthetic Aperture Radar

Grady Gills, James McGoldrick
James Maher
United States Air Force Academy

Illegal, unreported, and unregulated (IUU) fishing threatens ocean ecosystems globally and jeopardizes U.S. Economic security. Additionally, IUU Fishing has been shown to increase climate change, as well as increase the likelihood of military conflict over maritime resources. Synthetic Aperture Radar (SAR) can be used to locate and identify IUU vessels regardless of light levels or cloud cover, but a limited number of trained SAR analysts can interpret the data. In participation with the Defense Innovation Unit Xview3 Challenge, cadets from the United States Air Force Academy Department of Computer Science tackled data storage and space complexity problems to store 10TB of imaging data, and then trained a Convolutional Neural Network using the stored data. The resulting inference model is able autonomously classify maritime objects in SAR imagery as vessels, and additionally to determine if the identified vessels were fishing. By combining current fishing vessel detections and locations with Naval transponder data, authorities can determine if an identified fishing vessel is engaging in IUU fishing activities.

USAFA Utilizing Highly Motile Genetically Engineered Bacteria to

David Hatfield
Dr. Jordan Steel, and Dr. Chia Hung
United States Air Force Academy

Biocementation presents a unique method for creating structural material. The microbial enzyme, Urease, catalyzes the formation of the product calcium carbonate, which helps bind soil/sand particles together. We hypothesize that if bacterial motility can be enhanced, the penetration depth of the microbes may be greater and result in thicker Biocementation. Current techniques are able to solidify sand substrates into cement-like material, but after a topical application, the hardened cement is only a few inches thick. A simple transformation of the Urease plasmid into a bacterial species with a mechanism for motility maintains the function of this critical enzyme. Subsequently, assays at different soil depths will reveal bacterial motility's effectiveness, and structural strength tests can identify relative cementation strength at these depths. Biocementation has been of particular interest for its unique ability to solve complex structural problems. The demand for optimized yet structurally effective Biocementation treatment is rising. Getting deeper penetration and a thicker layer of hardening would be critical for applying this technology, especially in the context of airfield operating platforms (i.e. runways or aprons) and extra-terrestrial uses (i.e. lunar structural foundations).

Utilization of Wearable Fitness Tracking Devices to Predict Airman Health

Madison Hofmann, Scott Kinross
Lt Col Lemay, Capt Forbes
United States Air Force Academy

Currently all military members in the United States Air Force are required to take biannual physical fitness assessments (PFA) that are known to be significant stress inducers. As a potential alternative to the PFA, we analyzed the data obtained from wearable fitness devices to predict an individual's level of fitness and health outcomes. To accomplish this, we performed descriptive analysis to illustrate wearable fitness tracking abilities and accuracy based on a predictive model of health metrics. We developed mathematical models to predict the fitness level of individuals from their wearable fitness data and describe how these predictions may be used by Air Force leaders as an alternative to the current biannual fitness assessments for all Airman.

Totally Tubular: Determination of the Effect of Sonication on the Length and Purification of Single Walled Carbon Nanotubes

Laurique Hughes
Dr. Kevin Tvrdy
University of Colorado Colorado Springs

Single walled carbon nanotubes (SWNT) are purified by passing individual aqueous suspensions through a Sephacryl, S-200 gel bed in the presence of 2 wt% (70mM) sodium dodecyl sulfate (SDS). Different lengths and chiralities of SWNT adsorb to the surface of the hydrogel beads and are then eluted with 5 wt% (170 mM) SDS. Suspensions of individualized SWNT in 2 wt% (70 mM) SDS are generated through tip-horn sonication, which unbundles as-produced carbon nanotubes. During sonication scissioning of individual tubes occur, shortening SWNT lengths present in solution. It is hypothesized that shorter SWNT length will lead to greater interactions with hydrogel bead surface(s) due to a greater surface area of the tube can bind to the hydrogel surface. The effect of physical SWNT length on the ability and efficiency of different chirality SWNT to adsorb to Sephacryl, S-200 microspheres was determined using "underloaded" column conditions. During underloaded conditions there are more hydrogel binding sites than SWNT introduced. Increased sonication time showed an increase in overall abundance of individual SWNT present in solution. The absorption spectra pre- and post-interaction with the hydrogel beds indicated that despite having an overabundance of adsorption sites for the SWNT, there was a lack of complete SWNT uptake. SWNT uptake efficiency and elution efficiency data of aqueous suspensions were collected and correlated with length-of-sonication. Future work includes measuring the length of individual SWNT sonicated for varying time intervals before and after hydrogel interactions through atomic force microscopy (AFM) and scanning electron microscopy (SEM) to determine the effect of SWNT length of purification.

Exercise Study Recruitment in Active Populations

Seychelle Ibrahim
Lt Col Odaro J. Huckstep
United States Air Force Academy

Aerobic performance is strongly correlated with cardiovascular disease and all-cause mortality. Accordingly, many clinical studies assess exercise performance. Recruited volunteers for exercise research are often more physically fit than the target population, which confounds outcomes. Whether such recruitment bias is present in active populations is poorly understood. In this investigation, volunteers for exercise trials within active populations are hypothesized to be more fit than the general population from which they are recruited. To test this hypothesis, a pilot study was initiated within an exercise trial assessing maximal effort 1-mile run times at the USAF Academy while controlling for nasal obstruction. Standardized Aerobic Fitness Test (AFT) scores were compared in recruited volunteers vs. the general cadet population. Roughly one third of the target recruitment goal has been met which limits present statistical power for this pilot study. The concept has proven viable, however, particularly in populations such as the military that maintain recorded standards for exercise activity or performance. Completion of this study will inform further investigations which may reveal key insights to better guide recruitment and data interpretation strategies, thereby optimizing applicability and utility of exercise research in active populations.

Development of a Particle-Image Velocimetry System for Hybrid Rocket Motors

Andrew Jariga, Thomas McLean
Luke M. Sauter
United States Air Force Academy

This paper outlines the systematic development of a particle-image velocimetry system for determining the exit velocity of hybrid rocket motors. In-situ velocity measurements create disturbances in flow dynamics which can reduce accuracy. This has driven the need for accurate non-intrusive measurement techniques. This work seeks to demonstrate the relative feasibility of using PIV in hybrid rocket applications with a relatively low-cost test setup. A PMMA/GOx hybrid rocket was used to develop and test the PIV system which included a pulsed laser, high speed camera, bandpass filter and seeding particle device. The laser and seeding particle systems were developed using low-cost, experimental components to demonstrate the ability to construct an effective PIV system at an affordable price. After collection, the data was analyzed in MATLAB using centroiding techniques. From the results of this analysis, it is concluded that the developed system provides a viable method for determining exit flow velocity of a hybrid rocket motor.

Kinematic Analysis of Maneuvering Flight in Bats

Chris Joiner, Armon Ranjbar, Abigail Shultz
Jonas Håkansson and Aaron Corcoran
University of Colorado Colorado Springs

Flight has only evolved three times in living animals—bats, birds and insects. Bats are unique among these flyers in that they have heavy, many-jointed wings that are highly compliant. Most research on flight has been conducted in highly controlled conditions such as wind tunnels where animals exhibit steady, controlled flight. We conducted research to determine flight turning kinematic patterns in bats flying in a large flight arena to determine unique flight techniques and differences in patterns between species. Bats were filmed with high-speed infrared cameras flying in a large flight arena in Austin, TX in 2020 and in Arizona in 2021. The video data of three species of bats were chosen for turning flight analysis: *Lasiurus borealis* and *Nycticeus humeralis* from the Austin recordings and *Myotis ciliolabrum* from the Arizona recordings. The videos were digitized by identifying 16 anatomical points of interest on the bats which were then used to train a deep learning computer program (DeepLabCut) to automatically place the points frame by frame in each video. These points are used to measure the motion of the anatomy for each flight path. Views from three cameras were used to convert two-dimensional detections into three-dimensional real-world coordinates. When average kinematic parameters are analyzed for each species of bat observed, the patterns and techniques used for each species can be further analyzed and compared to determine significant differences in flight patterns between species. These data will be used to test long-standing hypotheses regarding the mechanics and evolution of bat flight that have yet to be tested with empirical data.

Overestimation of Self-evaluation of One's Performance

Amy Kang, Maya Thorson
Dr. Silz-Carson and Lt Col Tucholski
United States Air Force Academy

Competition tied in with self-evaluation can trigger dishonesty in even the most honest person. In many professional settings, including in some parts of the United States military, subordinates are required to provide significant input about their work performance to their superiors as a part of the performance appraisal process. In some cases, subordinates are expected to draft their own performance appraisals. These appraisals may then be used to rank-order subordinates to determine who receives a limited number of rewards, such as a "Definitely Promote" (DP) rating of an officer in the United States military. The research question under investigation in this experiment is whether this form of competition for a limited number of rewards induces individuals to overstate the quality of their performance, something which could be considered a mild form of lying. We are planning to conduct this research through a matrix solving game through an Amazon program called Amazon Mechanical Turk (MTurk). In the game, participants will be given 20 matrices of 12 numbers and will be asked to select the two numbers in each matrix that add up to 10. The participants will report two statistics: (1) the number of matrices that they believe that they solved correctly; and (2) the average time that they think it took them to solve each matrix. We hypothesize that under a competition-based compensation scheme, one is more likely to overstate the quality of their performance.

Direct Carbon Capture Future Outlook in Cities

Jackson Kenney
Dr. Beauregard, Dr. Ashtiani
United States Air Force Academy

Carbon Capture Technology is seen as an important aspect of meeting global climate agreements. This will allow the world more time to switch to renewable resources. The captured carbon can be used in a variety of functions to include increase oil drilling operations, carbon products, and being stored underground. Carbon Capture Technologies can be highly energy intensive and is beneficial to be placed closer to renewable energy sources. This article will explore the scalability of Direct Air Carbon Capture Technology in cities. The benefit of such a system is in the air quality improvement in cities as well as decrease the growing impact that cities have on the environment. The advantages and disadvantages of these systems will be presented and how they can be implemented into city infrastructure planning. The paper will expand on the recent government actions in the United States to increase research and development in the field to meet current climate goals. The goal of this paper will be to show the cost effectiveness of direct air carbon capture technology and the market feasibility of captured carbon in consumer products. The best outcome for direct air carbon capture is significant investments in research to develop cost effective systems. The emphasis of this paper is not that direct air carbon capture is the solution to climate change but is an important part of meeting global climate goals in conjunction with renewable sourcing of materials and energy.

Analysis of Efficacy and Efficiency of CRISPR Gene Editing in Fission Yeast

Hadeel Khammash
Dr. Amy Klocko
University of Colorado Colorado Springs

CRISPR gene editing has the potential to make precise genome changes. However, the efficacy of this approach can vary. A goal of our work is to evaluate CRISPR targeting one gene in fission yeast. Yeast with changes to the AVT5 gene should gain the ability to grow on salt, a condition that normally kills the cells. Data from a lab experiment with unexpected results was used as a basis for this study. Yeast had been transformed with a CRISPR construct targeting the AVT5 gene and were being tested with salt plates to identify salt-tolerant yeast. Oddly, all yeast grew on the salt, even yeast that did not receive the CRISPR construct. Sequencing the AVT5 gene showed that there was no genetic changes, which mean the amount of salt was too low and that the targeting did not work. Therefore, we decided to identify a lethal dose of salt and to repeat the yeast transformation to gain more colonies for testing. In brief, competent yeast are transformed with the CRISPR plasmid and grown for colonies before testing on salt. Salt-tolerant colonies are isolated, DNA purified, and sent out for genetic analysis. Experimental yeast samples are compared to WT DNA, and success is indicated by genetic changes in the AVT5 gene. Success with such experiments can be seen in large scale medical experiments on diseases like muscular dystrophy and the work that is being done to aid in advance the research done to potentially treat diseases like this in the future.

Determination of the Change in Molecular Volume of an Aqueous Alcohol Solution and its Implications on Hydrogen Bond Length

Michael Koogle
Dr. Kristin Rowan
Pikes Peak Community College

The observation that led to this investigation was as follows: when two miscible liquids formed a homogeneous solution their volumes were not additive. In layman's terms when 1.0 mL of water and 1.0 mL of ethanol were combined the resulting homogeneous solution's overall volume was less than the expected 2.0 mL. The use of this phenomenon was to investigate the intermolecular interactions between the two liquids, particularly their hydrogen bonding, which became the focus of this investigation. The deviation of the expected volume of a solution of ethanol and water at varying mole fractions was measured. This experiment was replicated using a solution of methanol and water, with particular attention paid to the mole fraction at which the solution volume reached its lowest value, the point at which the maximum deviation from the expected volume was reached. The ethanol solution reached this point at a mole fraction of 0.264 moles of ethanol with a maximum deviation of -2.55 mL, whereas the solution of methanol and water reached this point at a mole fraction of 0.314 moles of methanol with a maximum deviation of -4.10 mL. The volume per molecule at which the ethanol had reached its maximum deviation was $4.57E-23$ ml/mlc and the volume per molecule at which the methanol had reached its maximum deviation was $3.95E-23$ ml/mlc. The results seem to imply that the discrepancy in the volume per molecule is due to the differing lengths of the hydrogen bonds between the alcohol and water, the shorter carbon chain of the methanol made it so that the bond between its oxygen and hydrogen was more polar, allowing it to get closer to the water molecules.

Evaluating the Extent of Inquiry Occurring in Colorado College Classrooms

Cat Krupka
Michael Taber, Ph. D.
Colorado College

The purpose of this study was to evaluate the extent to which inquiry-based learning is occurring in classrooms at the liberal arts college Colorado College. The study sought to gain insight into the relationship between occurrence of inquiry and the class environment. In determining what inquiry looks like at the college, another research objective was to instigate further research into improving inquiry-based learning. The research consisted of a phenomenological, case-study, non-experimental, mixed-methods study in which classroom observations were structurally coded to the McGill Classroom Level of Inquiry Checklist (Oppong-Nuako et al., 2015). The observed students completed a questionnaire on their perception of inquiry occurring in their classroom and their class environment. The results showed that levels of inquiry-based learning at the college are not as high as possible, with one of the four classes observed exhibiting Most inquiry, while two exhibited Middle inquiry and one exhibited Least inquiry. Data produced from the questionnaire was limited by the number of participants but demonstrated a strong positive correlation between classroom inquiry and positive class environments. This suggests further research is required on the creation of a classroom culture that promotes high inquiry learning.

Quantification of 1-Dodecanol in Single Walled Carbon Nanotube Solution

Natasha Mastalka-Tatro
Dr. Kevin Tvrdy
University of Colorado Colorado Springs

Single walled carbon nanotube purification can be realized by passing surfactant suspended single walled carbon nanotubes (SWNT) through a multicolumn system containing Sephacryl Gel, S-200. Sodium dodecyl sulfate (SDS) is a commonly used surfactant in the suspension of single walled carbon nanotubes for chiral purification. Carbon nanotubes are suspended in 2 wt% SDS through tip horn sonication and it is suspected that SDS is converted to 1-dodecanol (dodecanol) during sonication. The presence of dodecanol in carbon nanotube solutions has shown to prevent carbon nanotube adsorption to Sephacryl S-200 gel. To improve the SWNT purification process, the precise quantity of dodecanol in sonicated SDS was investigated. The conversion of SDS to dodecanol during sonication was quantified by the method of dodecanol extraction and gas chromatography (GC). SDS was purified by recrystallization to contain zero dodecanol concentration, prior to experimentation. A liquid-liquid extraction method with hexanes and recrystallized 2 wt% SDS was validated with spike and recovery, yielding percent recoveries above 80%. Concentrations of dodecanol were quantified by an external calibration curve. The rate of conversion of SDS to dodecanol during sonication was studied by sonicating recrystallized SDS in progressive time intervals, followed by extracting dodecanol for GC analysis. The next steps in this research include, defining new methods of SWNT suspension, that inhibit the conversion of SDS to dodecanol. We expect findings from this project to improve SWNT gel adsorption during the loading stage of purification and allow for improved SWNT purification.

Sex Identification of *Vanessa cardui* Through PCR Testing

Katheryn McIntyre
Dr. Hollis-Brown
University of Colorado Colorado Springs

In painted lady butterflies (*Vanessa cardui*), the most commonly used technique for distinguishing sexes is by observing differences in the shape of the abdomen. The objective of this research was to develop a genetic test to identify accurately male and female painted lady butterflies, using a small portion of the wing as a sample. We identified a sequence unique to the W chromosome in females that could be amplified using polymerase chain reaction (PCR). Dried butterfly specimens were identified as male or female through consensus of two observers based on abdomen shape, and samples of the wings and abdomens were taken for testing. Results of the PCR showed that both the wing and abdomen samples yielded sequences of the expected size. This indicates that wing sampling can provide a nonlethal means of tissue sampling in these butterflies. We also found that several individuals that were initially identified by both observers as one sex were identified as the other sex through PCR testing. This suggests that identifying sexes solely based on abdominal shape is unreliable and cannot be used as a definitive method of sex identification.

Understanding the Immune System – Epstein Barr Virus Interaction

Kyrie Milliron
Dr. James Kovacs
University of Colorado Colorado Springs

Complement Receptor 2 (CR2) is the obligate human host receptor for the Epstein Barr virus (EBV). The viral surface glycoprotein 350 (gp350) is known to interact with CR2 on human immune cells, resulting in viral infection. EBV infection results in either an asymptomatic response as a result of infant infection or a symptomatic response clinically known as infectious mono resulting from infection later in life. Regardless of when the initial infection occurs, the virus will remain latent in the body until the immune system becomes compromised. This latency has been suggested to be related to many different cancers and diseases. Currently there are no therapies or vaccines against EBV. The results we present are the first steps in understanding the molecular interactions required for the infection of immune cells by the EBV. To date, we have preliminary binding data, protein crystals, and preliminary diffraction data. In order to continue working towards determining the three dimensional co-structure of CR2 and gp350, we have completed and confirmed the required cloning to express the proteins in human cells. We have also completed the production of the DNA needed to start human cell expression of the proteins.

Psychological and Somatoform Dissociation in Binge Eating: Development of the Dissociative Eating Scale

Julia Nolan
Tricia Waters
Colorado College

Binge eating is very common in the general population, with U.S. prevalence rate estimates reaching up to fifty percent, and binge eating disorder (BED) is the most common eating disorder. Dissociation is associated with disordered eating tendencies that involve binge eating behaviors. Dissociation can be a maladaptive emotional regulation strategy utilized to distract oneself from negative affect, and, when paired with a food stimulus, dissociation can lead to overeating or binge eating. The Dissociative Eating Scale (DISS-EAT) was constructed to assess the dissociative phenomena one may experience when overeating. The DISS-EAT scale demonstrated good reliability and construct validity. Somatoform dissociation (which regards one's experience of their own body), rather than cognitive dissociation, more strongly predicted DISS-EAT scores, suggesting a need for a shift towards more embodied, integrative treatments for disordered eating.

Analysis on the Mathematical Principals of the Game Go

Quinn Popielarczyk
Professor Mahan
Pikes Peak Community College

The game Go (also known as Baduk, Weiqi and Igo) is a 4000 year old Chinese game that has been a brilliant testing ground for both computer science and mathematics in the recent years. The game consists of two players placing black and white stones on the intersection of lines of an $n \times n$ grid, with $n=19$ being the standard. Using fundamental principals of graph theory and John Nash's non-cooperative game theory, this research attempts to establish the foundations for a predictive model of the game using algorithmic reasoning. Binary values that represent unique conditions of the stones can be plugged into a series of graph theory applications. When these applications are then altered into the appropriate format, they can fit into a variation of Nash's theorems to yield a result. This defined subset could then, in theory, be used to determine the strengths and weaknesses within group structures especially for opening moves.

The effect initial mass of copper has when calculating the empirical formula for copper sulfide

Evan Schaible
Kristin Rowan
Pikes Peak Community College

This research was conducted due to discrepancies in a class experiment when trying to find the empirical formula for copper sulfide. Based on the data observed in class we assumed that the starting mass of copper would impact the resulting empirical formula. To test this theory we took multiple different masses of copper ranging from 1 gram to 2.5 grams and heated them in a crucible with excess sulfur repeatedly. Following the completion of the heating cycles the empirical formula was calculated for the created copper sulfide. During the experiment the data we found suggested that the starting mass of copper does not matter as if you continue to heat the copper with excess sulfide the empirical formula you will always get eventually is copper (II) sulfide.

Orthorexia: When disordered eating becomes a moral good

Maya Sikora
Dr. Tricia Waters
Colorado College

This study examined the morality of disordered eating particularly as it relates to orthorexia nervosa and self-critical perfectionism. A new scale was developed to measure concerns specifically about Moral Purity of Food and Eating (MPFE). The research aimed to discover whether and to what extent the MPFE was related to general concerns of moral purity using the Moral Foundations Questionnaire (MFQ), disordered eating attitudes using the Disordered Eating Attitudes Scale (DEAS), Self-Critical Perfectionism (SCP) using the subscale of the Big Three Perfectionism Scale (BTPS), and orthorexia split into two subscales of healthy (HO) and unhealthy (ON) using the Teruel Orthorexia Scale (TOS). Adult female participants were recruited from Amazon mTurk to complete the surveys along with the new scale and some demographic questions.

The MPFE showed excellent reliability and good content validity because it was correlated with the other scales, as it was predicted to be conceptually related. The MPFE was the strongest significant predictor of ON, followed by the DEAS and SCP. The MPFE also moderated the relationship between SCP and ON. Future studies should further examine the MPFE and test it with male and non-binary populations.

Objective and Subjective Help Seeking Behaviors in Children

Alisha Silkey

Michelle Shields and Diana Selmeczy PhD
University of Colorado Colorado Springs

Help-seeking is a strategy that can promote learning. However, previous research has measured help-seeking using different methods. Some research has used objective measures of help-seeking during a cognitive task while other research has used subjective self-reports of help-seeking through questionnaires. Therefore, we do not have a strong understanding of how help-seeking develops in children using the same methods and whether these two methods yield similar conclusions. This current study examined the relationship between objective measures of help-seeking measured during a memory task and self-reported help-seeking measured through a questionnaire in children ages 8 to 13-years-old, (N=42). Results showed that children who self-reported engaging in less adaptive help-seeking behaviors also self-reported avoiding seeking help. Additionally, we found a positive association between self-reported help-seeking and objective help-seeking such that children who asked for help more frequently in the memory task were also the ones who self-reported more adaptive help-seeking. Overall, these results suggest that children can self-reflect about their general help-seeking intentions. However, the relation between objective and self-reported measures were only moderate, suggesting these measures may capture different aspects of help-seeking.

Curcumin diminishes oligomeric A β binding to a model lipid membrane

Daniel Soto

Dr. Crystal Vander Zanden
University of Colorado Colorado Springs

Alzheimer's disease (AD) is the 6th leading cause of death in the US, affecting more than 6 million Americans. In AD, the protein Amyloid Beta (A β) aggregates from disordered monomers, to intermediate fibrillar oligomers (FO-A β), to β -sheet rich fibrils and plaques. FO-A β is neurotoxic and is known to disrupt cell membrane structure. Alongside its antioxidant and anti-inflammatory benefits, the polyphenol curcumin has received attention for its ability to reduce A β 's toxicity in cell culture and AD animal models. In this study, we propose an in vitro approach to determine curcumin's role in soliciting FO-A β interaction in a DMPG monolayer, which serves as a model cell membrane. Protein-lipid interaction was assessed via Langmuir trough assays by observing changes in membrane surface pressure (π). FO-A β was injected beneath a DMPG monolayer, and π was monitored to determine protein interactions. To assess curcumin impacts, curcumin was co-incubated with DMPG at various times (30 min or 2 hrs), followed by FO injection. In absence of curcumin, FO-A β insertion increased membrane surface pressure by ~ 2 mN/m,

diminishing to ~1 and even 0 mN/m, during curcumin co-incubation at 30 min and 2 hours, respectively. Overall, curcumin administration was found to reduce FO-A β membrane interactions.

PFOAs Effect on Brassica rapa And Feeding Efficiency of Trichoplusia ni That Feed on Them

Giovanne Wilson
Dr. Emily Mooney
University of Colorado Colorado Springs

Perfluorooctanoic acid (PFOA) is a persistent contaminant of water, air, fish, and soil around the world. There have been few studies on how these chemicals affect terrestrial food webs. In this study, we tested the effects of PFOA on plants (*Brassica rapa*) and the feeding efficiency of the caterpillars (*Trichoplusia ni*) that fed on those plants. We treated plants with 0ng/mL, 400ng/mL, and 800ng/mL and the PFOAs had a significant effect on the reproductive structure of the plants. There were more fruits, flowers, and buds seen on the plants that did not receive treatment and fewer fruits, flowered and buds on plants that did receive PFOA treatment. There was a significant treatment effect on leaf area, with a significant difference between 0ng/mL and 800ng/mL, with plants with no treatment having larger leaf area. The feeding trial showed that the PFOA treatment had significant effects, with feeding efficiency being highest with no treatment (0ng/mL) and declining with the 800ng/mL having the lowest feeding efficiency. Our results suggest that PFOA can limit energy movement from plants to animals in contaminated food webs.

Photophysical Properties of a Series of Gold (I) Complexes

Zheng Yung
Ethan Holt, Kimberly De la Harpe
United States Air Force Academy

Due to their tailorable emission properties, gold(I) complexes are exciting options for OLEDs and non-linear optical materials. In collaboration with the Air Force Research Lab and Case Western Reserve University, the photophysical properties of a series of diphenylamine-substituted fluorenyl moieties with gold(I) *s*-alkynyl or *s*-triazole linkages were studied. The complexes all exhibit ultraviolet absorption and room temperature dual luminescence in the visible range, with an emission color dependent on the ancillary ligand and gold-ligand attachment. The observed room temperature phosphorescence of these complexes prompted a further study of their excited state dynamics. Notable features include a broad excited state absorption centered near 600 nm and triplet lifetimes ranging from 170-500 ms. The presence of triplet-triplet annihilation in these complexes was shown through energy-dependent delayed fluorescence and time-dependent triplet decay measurements.

Poster Session 2

1:00-2:30 pm

The Enigma of Salvador Dalí

Dee Androsiglio

Dr. Kristen Galvin

University of Colorado Colorado Springs

In 1929, Salvador Dalí joined the Surrealist movement in Paris. From the beginning, his relationship with the collective and its founder, André Breton, was shaky at best. Dalí was a contrarian at heart and loved stoking the fire to elicit reactions from others. Using iconographical, social historical, psychoanalytical, and biographical methods of examining Dalí's two paintings, *The Enigma of Hitler* (1937) and *The Enigma of William Tell* (1933), I will reveal how his fascination with the rise of Hitlerism and authoritarianism in Europe reflected his own personal beliefs. Salvador Dalí was personally seduced by fascism (as understood before World War II) and showed this fascination with Hitlerism through the various influences in his life, including the Spanish Civil War and his relationship with his father. Between T.J. Clark, Sigmund Freud, and even Dalí himself, there are many who's theories will help me examine the historical context and personal intentions of Salvador Dalí to prove that he did not espouse these beliefs purely for shock value.

Development and Characterization of Perfluoropyridine Polymers via RAFT Polymerization Techniques

Zachary Auleciems

Abby R. Jennings

United States Air Force Academy

The extensive scientific and industrial applications of fluorinated polymers are motivated by the need for materials that are thermally, mechanically, and chemically stable. This unique class of materials has been utilized in a variety of areas, including advanced surface coatings, medical devices, structural components, and many more. Herein, a perfluoropyridine (PFPy)-based monomer was synthesized and employed in the preparation of fluorinated polymers. To understand and quality the impact of chemical composition, networks of fluorinated monomers were copolymerized with methyl methacrylate (MMA) to produce a range of copolymers that vary by structure. These copolymers were prepared using RAFT polymerization techniques and characterized using TGA, DSC, GPC, MALDI, IR spectroscopy, and multinuclear NMR spectroscopy. The results of these studies will be further discussed.

Radiation Protection by Varied Densities of Lunar Regolith

Jake Branham, Kaitlin Roberts
Captain Meghan Quadrino and Dr. Reza Salehi Ashtiani
United States Air Force Academy

In anticipation for future, long duration lunar civilizations, a study of radiation shielding using lunar regolith is presented in this paper. Different densities of compressed regolith with several ratios of additives are investigated. The additives investigated are powdered polyethylene and powdered lithium hydride. Analytical simulations using NASA's OLTARIS tool effectively indicate the radiation dosage that is both shielded and transmitted through the lunar regolith samples. These samples are then constructed using a lunar regolith simulant mixed with either powdered polyethylene or powdered lithium hydride. These samples are tested at Kirtland Air Force Base's High Energy Research and Technology Facility. This paper presents the analytical solutions from OLTARIS, a process for compacting these densities for testing, and exact radiation doses extracted from the experimental tests. This study concludes that reasonable radiation protection conditions can be met, and mixed crews can live on the lunar surface with the recommended density and additive.

Teaming Academy Swarm Challenge (TASC)

Lindsay Brummett, Christopher Katz, Zachary Olszewski
Lt Col James Maher
United States Air Force Academy

The Teaming Academy Swarm Challenge (TASC) is a joint project between the Air Force Academy's departments of computer science and electrical engineering. The goal of which is to design, implement, and test autonomous interactivity, i.e. "swarming", between remotely piloted vehicles. While applicable to a variety of vehicle types such as rovers and fixed wing aircraft, the vehicles chosen for this project consisted of drones. The drone(s) are controlled by a single Ground Control Station that is also responsible for sending and receiving data. Following takeoff, the objective of the drones is to surveil, locate, and interact with ground-based targets while engaging in swarming behavior with other airborne drones. The targets are made up of low-energy Bluetooth transceivers that simulated downed airmen, friendly communication nodes, enemy communication nodes, and attack nodes. The drones are likewise equipped with Bluetooth payloads designed to interact with these targets and make autonomous decisions based on the target type. The efforts of this project are aimed at real-world applications such as Combat Search and Rescue, close proximity reconnaissance, intelligence sharing, target identification, communication hopping, communication jamming, and more.

Virtual Reality Game Development

Holden Caraway, Joshua Krutz, Caleb Price
Steven Fulton and Benjamin McGraw
United States Air Force Academy

Virtual reality (VR) development spans across a multitude of computer science disciplines including artificial intelligence (AI), networking, and graphics. Looking to explore videogames in the context of academic research, we created Vexville. Vexville is a virtual reality game available (in ALPHA) on Meta's Oculus platform via a Quest or Quest 2 VR headset. For our virtual reality game based in fantasy and wizardry, we required a system to handle spell casting. To meet demand, we created a shape recognizing LeNet-5 convolutional neural network which enables this classification in real time. AI also governs the movement patterns of our nonplayer characters (NPCs). Our VR game allows connecting with up to ten friends for an every-man-for-himself style battle. This networked session also enables voice chat. The scenery, player models, NPCs, and magic effects are custom models made in Unity and Blender. Together, these elements combine to synthesize our virtual world of Vexville.

The Impact of Cadet AFSC Preferences on Future Officer Retention

Ally Carlin, Kia Gawronski
Lt Col John Miller, Dr. Eric Tucker
United States Air Force Academy

The purpose of the United States Air Force Academy and Reserve Officer Training Corps programs is to develop leaders of character that will commission as Air and Space Force officers. As cadets near graduation, they input Air Force Specialty Code (AFSC) preferences for the jobs in which they are interested. They are then classified into AFSCs based on education requirements, needs of the Air Force, and their preferences. This paper studies the effects of receiving a top AFSC preference on cadets' future retention in the Air Force. To measure this effect, we matched cadets that received a top preference with cadets that did not and compared their retention outcomes. We also explored supervised machine learning approaches to this problem, such as random forests and decision trees. We are still evaluating the effects of receiving a top three preference on staying in past the five-year commitment. We hope to find a causal effect through broadening our approaches to this problem. Once finalized, these results can be used in conjunction with future research to improve the AFSC classification process and optimize retention outcomes.

Antibiotic Characterization of Marine Algal Extracts

Taryn Cates-Beier
Dr. Anthony Arment
United States Air Force Academy

The increasing antibiotic resistance from bacterial pathogens has created a strong need for new antibiotics. We tested six different marine algal extracts for antibiotic characteristics and differences in effectiveness against gram positive and gram negative bacteria. The disc diffusion assay was used to assess the effectiveness of these six extracts against 13 gram negative bacteria and seven gram positive bacteria. The extracts were solvated in methanol, ethanol and water. Precipitates were noticed when using alcohol as a solvent, these precipitates were then re-solvated in water and tested using Mueller-Hinton agar. Although the onset of the COVID-19 pandemic halted research, obtained results indicated no significant difference between the two different types of bacteria and the effectiveness of the extracts. There was also no significant difference between the effectiveness of the different tested solutions. Future research intentions were to use paper chromatography and *Chromobacterium violaceum* as the bacterial focus. If continued, the discovery of a novel antibiotic capable of quorum sensing inhibition could have potential microbe or cancer treatment implications regarding tumor cell signaling.

The Belt and Road Initiative in the Pacific: Implications of Infrastructure Investment in Fiji and Papua New Guinea

Phoenix Chang Roper
Vibha Kapuria-Foreman
Colorado College

In 2013, Chinese President Xi Jinping announced the Belt and Road Initiative (BRI), a global infrastructure investment plan to connect Asia with Africa and Europe. While the initial focus of the Belt and Road Initiative was to increase Afro-Eurasia connectivity, it has expanded to encompass other regions to become the world's largest development finance initiative. This expansion included the addition of the Pacific Islands to the Maritime Silk Road (MSR) beginning in 2017, including the Cook Islands, Micronesia, Fiji, Niue, Papua New Guinea, Samoa, Tonga, and Vanuatu. I provide a qualitative analysis of the two primary recipients of BRI-related investments in the region: Fiji and Papua New Guinea. Through a review of macroeconomic data and local news coverage on Chinese construction since 2017, I seek to understand how the initiative has economically and politically impacted these two countries and what has determined these outcomes. I hypothesize that BRI impact in the Pacific Islands depends on institutional quality and capacity, which will determine the ability of local governments to utilize funds effectively and repay outstanding debts.

The effect of cannabis on older adults' processing speed

Katrina Cooley
Rachel Thayer and Adrianna Gallegos
University of Colorado Colorado Springs

In the United States, cannabis use is rising across populations, including older adults (OA), raising questions about the possible effects of cannabis on OA cognition. Namely, the impact of use and age on processing speed and inhibition and implications on driving. This study recruited OA aged 60+ (N = 11, M = 69.00, SD = 5.12) via community flyers and online ads. Participants completed four weekly brief timeline follow-back (TLFB) surveys, capturing the quantity and frequency of cannabis use. Week four also included an interview and cognitive battery, containing the Color-Word Interference (CWI) subtest of the Delis-Kaplan Executive Function System. Two participants were excluded for incomplete participation. A bivariate Pearson correlation was conducted to analyze the sample's (n = 9, male = 5) relationships among age (M = 67.89, SD = 4.82), weekly use frequency (M = 5.22, SD = 2.44), and CWI average scores (M = 11.22, SD = 1.50). The analysis revealed a statistically significant negative correlation between age and CWI scores ($r = -0.74$; $p = 0.022$), such that increased age was associated with slower performance. No correlations were observed with days of cannabis use within the last week. It is expected that processing speed will slow with increased age. Frequency was not associated with processing speed, but future studies can examine other measures of cannabis such as potency and use within the day that the tests are given. Does this mean you made a composite of all of the scores? "Processing speed" would be color naming and word reading alone, while "inhibition" would just be the inhibition and inhibition/switching trials.

Adaptive Tutoring System: An Application in an Introduction to Computer Science Course

Cameron Cubra, Cameron Estep, Jacob Hall, Thomas Kyle, Evan Marrone
Lt Col Justin Wilson, Captain Kevin Cardenas
United States Air Force Academy

In this project, we explore a new approach to an online tutoring system which attempts to minimize the time to learn a concept or skill through maximizing the users time in the zone of proximal development. We leveraged concepts from past academic studies which were able to show improved performance in an online tutoring system through adaptive weighting of question difficulty and question ordering for users. We modified and applied this approach to the CS110 Introduction to Computer Science Course at the United States Air Force Academy. Using the CS110 Database, which uses scores and records results on every code submission throughout, we were able to evaluate question difficulty through the features of time between attempts, number of attempts, and score. Our tutor links a Graphical User Interface to the CS110 Database and the user's python file which contains the question and autograder. Leveraging historical question difficulty, our tutor enables a user practice topics and questions in an order which minimizes learning time, updating continuously as the user completes problems. We are currently finalizing our tutor and beginning to test on current CS110 students to validate our assumptions and approach.

Leveraging Data To Improve Urban Farming Operations

Kelly Dang, Colin Douglas, Jacob Waltermire, Rex Yee
Lt Col Brian Lemay, Lt Col John Miller & Dr. Gerry Gonzalez
United States Air Force Academy

Urban farming offers numerous benefits over traditional farming, to include reducing the need to transport crops long distances, but is often more expensive due to space limitations and the cost of urban real estate. In order to be successful, urban farms need to operate and use their space efficiently. To identify opportunities to improve the profitability of an urban farm, we conducted a thorough analysis of data from a local urban farm. From our analysis, we identified multiple opportunities in the farm's food development processes and distribution operations that can be altered to increase profit. By implementing data wrangling, comparative analysis, and profit maximization, we explain our analysis methods and show how they were used to inform farming decisions and increase profit.

Effective Intervention: Perspectives of Title I elementary school teachers on most significant inhibiting factors to effective literacy interventions

Psalm Delaney
Mike Taber, PhD
Colorado College

The purpose of this study was to investigate Title I elementary school teachers' perceptions of the most significant inhibitors to effective reading interventions and to describe teachers' solutions to such inhibitors. The research followed a phenomenological, non-experimental, mixed-methods design centered from a metaphysical orientation. The data analysis concluded five significant inhibitors to effective reading interventions: (1) incomprehensive curricula, (2) high teacher shortages, (3) insufficient collaboration time, (4) low student attendance, and (5) student home life factors. Teachers suggest that increased professional development for curriculum implementation, "protected collaboration time" within the school day, and efforts for increased parent involvement in student literacy may reduce the severity of these inhibitors. Many teachers deem home life factors to be outside of their control. Further research may be conducted to investigate parent perspectives on inhibitors to engaging in their child's literacy development.

Seeking Justice: The Jewish Volunteers of Offenbach Archival Depot, 1945-1949

Eisert-Wlodarczyk
Meredith Scott
United States Air Force Academy

In addition to being perhaps the greatest attempt at the mechanized destruction of an entire people in history,, the Holocaust was also the largest organized theft in history, and the end of the war revealed the massive problem that had come with peace: what to do with the millions of items stolen by the Nazis? The prevailing historical narrative which surrounds post Second World War restitution efforts places American service men at the forefront of restoring Jewish belongings, culture, and literature. In reality, Jews of all different backgrounds came together and worked to restore what they had lost. Many of these volunteers flocked to the Offenbach ARchival Depot located in the American occupied zone of Germany. The depot was under military command but the expertise and labor were provided by Jewish volunteers coming from international organizations, academia, religious groups, and much more. This story of Jewish volunteers at Offenbach Archival Depot is one of determination, bravery in the face of near complete destruction, and one that rights the historic misplacement of credit in saving Jewish artifacts and books.

Regression Analysis for Predicting URT Student Performance

Jonathan Farmer, Robert Martin, Sung O, Eve Schoenrock
Lt Col John Miller, Capt Ethan Salgado
United States Air Force Academy

The 558th Flying Training Squadron, the only Undergraduate RPA Training (URT) squadron is currently seeing a trainee failure rate of approximately 6%. The project team aims to predict student performance at URT using econometric regression strategies analyzing initial student data for selected trainees and identifying at-risk students early in the training timeline. The 558th seeks to enhance the performance of their trainees by identifying student trends indicative of success and failure prior to URT, enabling them to provide attention and resources to students in need. The team's goal is to provide the 558th with information that will help them reduce the failure rate at URT without requiring additional funding. We find GPA, PCSM, STEM, and PPL status to be significant indicators of student success.

USAFA Telescopes Limiting Magnitude Study

Seth Finley
Dr. Devin Della-Rose, Dr. Tim Giblin, Dr. Francis Chun
United States Air Force Academy

The United States Air Force Academy (USAFA) operates a wide range of telescope systems including a 1-meter, 0.4-meter, and a global network of eleven 0.5-meter telescopes (Falcon Telescope Network) for cadet and faculty space science research. We conduct a limiting magnitude study for these instruments using Landolt Photometric Standard star fields to determine the faintest apparent brightness detectable with a specific exposure time and filter. Following data collection and processing, two plots are generated: 1) magnitude histogram, and 2) magnitude versus magnitude uncertainty. This establishes the limiting magnitude of a specified signal-to-noise threshold for the USAFA telescopes, thus defining their observational capabilities (e.g., duty cycle) for space situational awareness and the study of celestial transient events.

Exploring the Epistemic Mechanisms of Threat: Comparing the Effects of Mortality Salience and Incongruity on Cognitive Performance

Brian Foster
Dr. Tom Pyszczynski
University of Colorado Colorado Springs

Whereas terror management theory posits that the awareness of one's mortality triggers distinctive defensive processes, the Process Model of Threat and Defense posits that diverse threats trigger the same defensive processes. The present study investigated how exposing people to tasks that triggered incongruent or death-related cognitions affects performance on a logic test that is sensitive to political bias. 468 participants were randomly assigned to one of four tasks containing one of the following stimuli: death word pairs, a death-related short answer question, incongruent word pairs, or congruent words pairs. It was hypothesized that death reminders increase logical errors in the direction of support for one's worldview, whilst incongruity reduces logical errors by triggering more careful consideration. Pairwise comparisons revealed significant differences in cross-party composite bias scores between the incongruent experience condition ($M = -.28$), and both the implicit ($M = .18$) and explicit ($M = .05$) death conditions, $p < .05$; where a lower score equals greater conservative bias, and a higher score, greater liberal bias. Consistent with the direction of change in cross-party bias, conservatives in the incongruent condition demonstrated significantly more bias ($M = -.63$) when compared to the implicit ($M = .05$) and explicit ($M = .05$) death conditions. While these results are contrary to the hypothesis, they demonstrate that responses to death and incongruity are dissimilar, which is inconsistent with the Process Model of Threat and Defense. I speculate that death reminders reduced political bias among conservatives by triggering a need to bolster stimuli related self-esteem.

UC Health Veteran Suicide Study

Juan Fuentes, Jaime Gustitus, Paige Luebbering, Ruben Vera
Lt Col Brian Lemay, Lt Col John Miller, Dr. Aaron Albert
United States Air Force Academy

In 2019, the suicide rate among veterans in the US is 52% greater than the general population when adjusted for sex and age. In El Paso County, where there are 4 of the 7 military bases in the state, the rates are significantly higher than the national veteran suicide rate and the general population. Despite the clinical healthcare provided to those who suffer from mental illness, the suicide rates have only increased in the past year and a redefinition of the suicide problem is needed. In this case study, we seek to determine which intervention techniques are the most effective when given the socioeconomic makeup of various establishments. By creating an application that analyzes the characteristics of all individuals within an organization or a hospital environment, we are then able to provide doctors or healthcare providers with an aggregate analysis of the overarching problems and suicide risk factors the population has. This analysis tool will be beneficial to the healthcare system as it will continually update and give the most relevant information possible allowing healthcare providers to make data driven decisions on their patients and where to direct their funds to most effectively solve their problem at hand.

Forensics Entomology and the Effects of Climate Change

Riley Gentsch, Brianna Gill, Celestyn Webber
Jennifer Wawrzonek
Pikes Peak Community College

In this research project we will be focusing on Forensic Entomology. Forensic entomology is the use and study of insects in forensics to help investigators determine and examine a crime scene. We will go more in depth of what forensic entomology does and how it is used in specific crimes. We will also be discussing how climate change is affecting forensic entomology and how that might change the process of forensic entomology. We collected our data through research rather than experimentation because it was difficult to find a local forensic entomologist.

SARS-CoV-2 Surveillance System Using Wastewater Based Epidemiology

Gabriella Gerving, Phillip Golder
Dr. Jordan Steel
United States Air Force Academy

As the COVID-19 pandemic continues with no end in sight, surveillances systems must evolve to minimize the impact that testing and outbreaks have on a population. As this pandemic progresses, the need for a population-focused surveillance test has led to the development of Wastewater Based Epidemiology (WBE) testing. WBE analyzes human waste for the presence of disease-causing microbes, and this analysis can be linked back to the clinical cases of that disease. The aim of this study was to set up a WBE

surveillance system, and to discover the field test's sensitivity compared to sophisticated lab tests. The field-based test indicates when a major outbreak will or is occurring, but not to the same detail of data analysis of a sophisticated test. The field-based test still shows proportionality in the values given, meaning it can be used to monitor the beginning, height, and end of an outbreak cycle, meaning it can still act as a useful and simple tool to help predict outbreak cycles without the specificity of a sophisticated test.

Abuse Towards Healthcare Workers

Rebekah Gomez

Robin Schofield

Pikes Peak Community College

I hope to discover a way to help bring some light and maybe help alleviate the problem surrounding the abuse on healthcare workers. I want people to realize that this is a common problem and happens all the time, from healthcare workers to other healthcare workers or more commonly patient abusing healthcare workers. This has happened to most every healthcare worker. I hope to show that these people all have a love to help people and should not have to deal with all the abuse they receive. A study that shows the trends of the abuse and such on healthcare workers should be completed as it would shine a light on this subject. This will be hard because it is a very taboo subject in healthcare. The healthcare workers are expected to care for the population in their darkest hours. It is expected that they can deal with all of the horrible things they see with little reaction. This is also true for the factor of patients abusing the healthcare personnel. It is expected that they do not retaliate or defend themselves when attacked. This expectation needs to change.

Investigation of Curcumin's Ability to Inhibit Amyloid Beta's Toxicity and Cell Membrane Interactions

Wendt Griffin

Crystal Vander Zanden

University of Colorado Colorado Springs

Amyloid beta ($A\beta$) has been experimentally shown to permeabilize membranes, resulting in cell death, due to its ability to aggregate creating toxic oligomers and fibrils found in Alzheimer's disease. An outstanding question is whether curcumin can inhibit $A\beta$ interactions with the membrane. Curcumin has been shown to reduce $A\beta$ toxicity and its ability to interact with monolayer membrane systems. To gain greater insight into $A\beta$'s ability to penetrate phospholipid bilayers, liposomes were created to perform a fluorescence leakage assay. It is hypothesized that treatments such as curcumin work to either prevent interactions, help form non-toxic oligomers, or de-toxify oligomers. $A\beta$ interacts with negatively charged phospholipids; therefore the liposomes were made with anionic POPG and a 7:3 molar ratio of POPG:POPC (POPC is zwitterionic) to mimic the inner leaflet of the plasma membrane. The vesicles were filled with the self-quenching fluorophore calcein to ensure no fluorescence would be recorded unless the membrane had been compromised. Our fluorescence data showed that monomeric $A\beta$ caused dose-

dependent membrane leakage indicated by calcein presence outside the vesicles. Furthermore, the fibrillar and non-fibrillar oligomeric forms showed membrane disruption. Preliminary data showed curcumin had an effect on liposome fluorescence, although more testing is necessary for further evaluation.

Isolation, Extraction, and Identification of Fluorescent Unknown in Friedel-Crafts Acylation of Biphenyl

Nicholai Hagemann
Dr. Kristin Rowan
Pikes Peak Community College

Acylation of biphenyl with acetyl chloride is a commonly used Friedel-Crafts reaction. Side products observed between the reactant and the acetylating agent are often due to incorrect stoichiometric quantities. Fluorescent complexes were observed and made the focus of this project, while a lack of interest and funding in these byproducts by traditional industries was the motivation. Isolating, extracting, and identifying these develops a methodology to separate compounds with comparable properties.

Determination of Anisotropy Factors of Nanomagnets

Victoria Martinez
Ezio Iacocca
University of Colorado Colorado Springs

Magnets are common materials that exhibit north and south poles, no matter the size. As magnets are shrunk down to the nanoscale, (a thousandth of human hair width) their shape induces a symmetry breaking called anisotropy [1]. Because of anisotropy, nanomagnets have a well-defined north pole orientation. Nanomagnets can be ordered in arrays that produce new materials with unique functionalities called artificial spin ices (ASIs) [2]. ASIs support magnetic waves which are potential candidates for future energy-efficient information and computation carriers [3]. However, ASI magnetic wave research remains predominantly experimental, and analytical methods are required to accurately model these materials. A crucial factor for an analytical model is the determination of anisotropy for realistic shapes. We aim to determine the anisotropy of nanomagnets for a variety of shapes. We take advantage of the natural dynamic response of magnetic materials, ferromagnetic resonance (FMR). We theoretically derive FMR for a general case that describes any nanomagnet shape. Then we will use a modeling program MuMax3[4] to compute the FMR numerically. Our derivation allows fitting the simulated FMR and recovery of the parameters that describe the anisotropy. We will first model an analytically exact ellipsoid [5], and then explore realistic shapes. Our results will contribute to describe magnetic waves in ASI and model devices for spin-based information technologies.

Use of Artificial Reproductive Technologies in the Conservation of Endangered Species

Tara Matula
Jennifer Wawrzonek
Pikes Peak Community College

More than 7000 species are listed as critically endangered across the globe. Many of these species are animals, including familiar high profile species such as *Pongo pygmaeus* (Bornean orangutan), *Elephas maximus sumatranus* (Sumatran elephant), *Panthera tigris* (tiger), and *Ailuropoda melanoleuca* (giant panda). Conservationists have explored many methods to attempt to preserve and protect these species with varying levels of success. One such method that has been utilized is artificial reproductive technologies (ARTs). These technologies include techniques such as intrauterine insemination (IUI) using fresh or frozen sperm and in vitro fertilization (IVF). Experts analyze lineages and determine ideal pairings to maintain genetic diversity in these endangered species. When numbers are critically low, it becomes even more important to pay close attention to such pairings to avoid the risk of dangerous genetic defects resulting from inbreeding. With the use of ARTs, gametes can be collected from anesthetized animals then shipped to a suitable match and reproduction can occur even when the pairing itself may be risky (such as when introducing tigers or when mixing gametes of animals in the wild and those in captivity) or after the death of a male with a valuable bloodline. A rich field of study to further this technology is the introduction of newer technology such as microfluidics to make ARTs more accessible in work with wild animals.

Near-field microwave scanning microscope for magnonics applications

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Modern magnonics requires tools for the investigation of spin-wave dynamics in frequency, time, and space domains. One of the most critical features is the ability to probe spin waves in out-of-plane magnetized materials. We report the design and performance of a near-field microwave scanning microscope capable of providing all these features. It uses a broadband microwave loop antenna as a probe, which can be positioned over a sample surface with nanometer resolution using a piezo-driven platform. The microwave signal is recorded by a fast oscilloscope. As an example of system performance, we will show the dynamics of spin waves in a Yttrium Iron Garnet ring. Research using the microscope is ongoing and will aid the study of new magnetic materials, with applications in data processing and computing.

Investigation of Post-mating Prezygotic Barriers in *Drosophila arizonae*

John McCoy

Dr. Jeremy Bono

University of Colorado Colorado Springs

Speciation is the process in which one population diverges into distinct species as a result of the accumulation of reproductive isolating barriers. When it comes to exploring these barriers of isolation, it is important to consider post-mating prezygotic (PMPZ) barriers as a potential force in speciation. In recent years the investigation of PMPZ isolation has resulted in the increased recognition that male seminal fluid has significance in the mediation of reproductive outcomes. We aim to investigate the gene GI26471 as this is a gene that is strongly suggested to contribute the PMPZ isolation of two species that recently diverged: *Drosophila arizonae* and *Drosophila mojavensis*. We have chosen to investigate GI26471 as it is found as both a protein and as RNA in the male seminal fluid. The first step of this experimentation is to demonstrate that GI26741 is involved in reproduction in *D. arizonae*. To do this, we are using the CRISPR genome editing system to create a stock of *D. arizonae* with a knockout (KO) mutation in the gene. Following the generation of this stock, males from the knockout stock (or wild type males as a control) will be mated to wildtype females. We will compare fecundity, fertilization efficiency, and the persistence of the insemination reaction between females mated to KO or wild type males). The insemination reaction is a clot like formation that appears in the female reproductive tract post mating. It is not well understood what causes this reaction, but it is suspected that GI26471 is involved in the formation of this reaction. We predict that if GI26471 is involved in reproduction, females mated to KO males will have smaller or faster degrading insemination reaction, a decrease in fecundity, and/or decreased fertilization efficiency compared to females mated to wild-type males.

A Look into Positive Action in India and Hungary

Nesmith, Mallory Nesmith

Douglas McKechnie

United States Air Force Academy

With the recent changes and revamping of the Hungarian constitution containing specifically criticism of the human rights protection, one begs the question, how to assure human rights within a constitution, and is affirmative or positive action necessary to truly guarantee equal rights? The Hungarian constitution takes a very open and vague approach, leaving the rights to be interpreted by the courts without explicitly stating many of the fundamental human rights guarantees that the Council of Europe and the European Parliament have recently expressed concern over. The Hungarian constitution just recently was amended to include some religious freedom, let alone ensuring extra guarantees to previously discriminated minorities. On the other hand India's constitution is riddled with positive rights and positive action in order to repair the human rights damages that have occurred in the past. These different constitutional approaches manifest themselves throughout the entire society, through the government's approach towards discrimination, and the ideals present within the main body of citizens all of which are discussed in this paper.

Optimization of Collaborative Autonomous Small Unmanned Aircraft Systems (SUAS)

Austin Patel
Lt Col John Miller, Lt Col Kevin Treat
United States Air Force Academy

With increasingly complex combat zones and advancing adversaries, developing large swarms of cost-effective Unmanned Aerial Systems may provide compelling capabilities for US (United States) Forces. Therefore, the research question concerns the optimal combination of existing UAVs that maximizes the probability of success while operating within time requirements, of being an effective component of the US military kill chain. Requirements for these sUAS were a flight time of at least 1.5 hours, a 2ms or better delay in sensing capability, and minimizing cost to less than \$150,000 a unit. A python simulation was used to gather performance data on different combinations of UAVs and a randomized target set in a 5nm radius. The results suggest that an Altius-900, Voly M20, and Matrice 100 drone are the most optimal. The combined cost is 1.25 million dollars. Using insights from the simulation, the team was also able to recommend what attributes were the most important to a successful mission, saving time and money in the development processes.

40-year Changes in Lipid Storage Differ Between an Endemic Moth (*Euxoa lewisi*) and a Migratory Moth (*Euxoa auxiliaris*)

Pease, Sydney Pease
Dr. Emily Mooney
University of Colorado Colorado Springs

Moths are some of the most diverse insects in the world, playing integral roles as pollinators and as food sources in different ecosystems. Interestingly, alpine moths have been seldom studied, even with pressures of global change taking place. The aim of this study was to recreate a 1981 experiment from the UCCS Biology Department, tracking abundance and lipid storage of alpine moths. Alpine moths feed from nectar of high elevation plants, adding lipids to their body mass for reproduction. Our prior research showed that the widespread migratory miller moth (*Euxoa auxiliaris*) no longer gains lipids while feeding at high elevation. In this project, we tested for this same pattern in the endemic moth, *Euxoa lewisi*. Results indicate no significant change in lipid percentage over the sampling year; however, abundance of moths in 2021 were notably higher than in the 1981 samples. These results suggest that endemic moths may be faring better with global change than migratory moth species. Migration can expose species to a variety of threats associated with global change, making migratory species vulnerable to population declines.

Building a web-based open-source deep neural network to predict blood-brain barrier permeability

Victoria Rosa
Sally Meyer
Colorado College

The blood-brain barrier (BBB) is a highly selective, semi-permeable membrane separating the brain from the circulatory system. Knowledge of a compound's ability to permeate the BBB is an essential factor in drug development. For drugs targeting diseases within the central nervous system (CNS), permeation of the BBB is necessary; furthermore, it is desirable that compounds designed to treat diseases outside the CNS do not cross the BBB to avoid consequences resulting from off-target interactions. A literature review was conducted to determine which molecular descriptors (e.g. molecular mass, charge, number of rotatable bonds) influence passage across the BBB. Using these descriptors, a user-friendly artificial neural network was built, trained, and tested using a data set of 2,304 molecules. This model predicts molecular passage across the BBB with a sensitivity of 96.1% and a specificity of 88.8%. Neural networks are increasingly utilized within chemical research; however, the movement towards *in silico* methods of experimentation is grossly underrepresented within the curriculum of introductory chemistry courses. Teaching modules, designed with the goal of creating course content that is applicable and engaging for general chemistry students, are in development.

Characterizing Ciliary Localization of Type 3 Adenylyl Cyclase Mutations in a Novel Obese Mouse Model

Madeleine Ross
Dr. Jeremy C. McIntyre
Colorado College

Mutations in type 3 adenylyl cyclase (ADCY3), a downstream GPCR effector that localizes to neuronal primary cilia, have been linked to obesity in patients and mouse models. However, the mechanisms by which ADCY3 contributes to obese phenotypes remain unknown. This project sought to characterize the localization of a mutant ADCY3 protein in a novel mouse model (ADCY3ΔGFP) using immunohistochemistry. While an antibody targeting the C-terminal epitope detected ADCY3 in wildtype (WT) mice, no signal was detected in mutants, confirming efficient deletion of that region. Using a secondary antibody to an intracellular epitope, no ADCY3 labeling was detected in WT or mutant mice. Previous studies have shown that specifically inhibiting ADCY3 in the paraventricular nucleus (PVN) is sufficient to produce obesity. We sought to determine if restoring ADCY3 in the PVN would reverse the obese phenotype present in ADCY3ΔGFP mice. WT and mutant mice were injected with adeno-associated viruses (AAV) expressing either a gain-of-function ADCY3 (ADCY3M297I) or a predicted non-ciliary localizing ADCY3 (ADCY3K465R). We then sought to confirm successful AAV targeting and ADCY3 localization in mutant mice. ADCY3M297I was found to localize to neuronal cilia; however, expression was largely outside the PVN. Interestingly, the ADCY3K465R protein exhibited strong membrane and axonal localization, but also was present in cilia, suggesting that the mutant protein can still be trafficked to cilia when overexpressed. Further experiments are necessary to identify the presence and location of mutated ADCY3 in ADCY3ΔGFP mice and to improve targeting for expression of AAVs in the PVN.

Characterizing Blood Marker Proteins for the Development of mRBCs

Nathan Scheidt

Dr. Jordan Steel, Dr. Orion Furmanski, Dr. Armando Estrada, Dr. Kristin Heitman, Dr. Vincent Ho
United States Air Force Academy

Blood transfusions save countless lives every year. Despite their utility in treating severe trauma wounds and illnesses, the availability of donated blood is extremely limited. The imbalance between supply and demand of blood is intensified not only by the requirements of scrupulous testing for diseases but also by the need for compatibility between donor and recipients, which severely reduces the opportunity for life-saving blood transfusions. The present project is a literature review performed to compare and gain additional information for various techniques being used for the expression of antigens on manufactured red blood cells (mRBCs). While producing red blood cells from hematopoietic stem cells to yield mRBCs has become a viable solution in combatting the blood shortage, mRBCs must likewise exhibit the proper antigens to avoid or reduce hemolytic transfusion reactions. Future in vitro and ex vivo experimentation of the reviewed methodologies will be required to confirm specific antigen expression on mRBCs. Overall, the ability to add various antigens to mRBCs will provide more compatible blood transfusions, reducing the occurrence of hemolytic transfusion amongst patients, and provide critical life-saving blood to those most in need.

Club Basketball in Colorado Springs: Shaping Success and Failure

Holly Siu

Dr. Eddie Portillos, Dr. Jeff Montez de Oca, Alexandra Hood
University of Colorado Colorado Springs

The purpose of this research is to explore how club basketball, specifically in Colorado Springs, shaped many aspects of a participant's life and investigate why youth and parents decide to partake in club basketball. The project also looks at the challenges and the benefits of being involved in a club sport. In addition, we explore how participation in club sports shapes relationships with parents and the community, and participation in delinquency. This study has been conducted via zoom with volunteers who are former players, parents, and coaches over 18 years old. Thus far, there is a full analysis of twelve interviews. The recording and transcription feature has been applied in order to further examine similarities and differences among the perspectives of our participants. From there, NVIVO has been utilized in order to code these transcripts and further inspect a few key findings that revolve around racial treatment on the court, sexuality and basketball, as well as delinquency/police and basketball.

Replicating PLATYPUS Findings & Analyzing MUNGE Encryptions

Jessica Hannebert
Dan Ellsworth
Colorado College

PLATYPUS attacks use power measurements to steal cryptographic keys (such as the ones we use in e-commerce). We set out to replicate the findings from the original PLATYPUS paper in a less controlled environment and find out whether the attack could be applied to a High-Performance Computing network. We found that, as the paper reported, different instructions in the x86 assembly language can easily be distinguished by their power consumption. Along the way, we also discovered some peculiar behavior in Intel RAPL counters. However, we were unable to replicate the paper's findings on distinguishing between operands of assembly instructions based on Hamming weight. Based on our experiments so far, using this attack against an HPC system would be difficult and fairly easy to prevent.

Perceived Stress and Aerobic Performance

Alli Kearns
Lt Col Odaro J. Huckstep DPhil, MSc
United States Air Force Academy

Stress is linked to cardiovascular risk and many adverse health outcomes. Elevated life stress and anxiety have climbed in recent years with markedly higher prevalence in young adults. In the UK, unmanageable stress affected nearly 74% of the adult population in 2018, and new research indicates a surge in global stress since the onset of the COVID-19 pandemic. Physical activity is frequently prescribed for stress reduction, with benefits largely mediated through improved sympathetic function. However, the inverse relationship, how stress may impact aerobic performance, is poorly understood. The hypothesis that perceived stress is inversely related to aerobic performance was tested in a pilot study in conjunction with research investigating the relationship between nasal obstruction and aerobic performance. Perceived stress was measured with a validated 10-question perceived stress survey (PSS-10) and analyzed for relationships to aerobic performance assessed by maximal effort 1-mile run times. Study recruitment is approximately 30% complete which limits statistical power for this investigation. However early trends suggest that perceived stress is inversely correlated with 1-mile run performance. Once completed, this study will offer clues regarding how stress impacts aerobic performance. These data will be useful in guiding future research, particularly in populations such as military and first responder communities that demand high physical performance under stressful conditions.

**Guideline Adherence During COVID-19:
Changes in Individual Willingness to Adhere or Vaccinate After Exposure to Falsified Data**

Scout Rhodes
Dr. Laith Al-Shawaf
University of Colorado Colorado Springs

The outbreak of the 2019 Coronavirus led to profound changes in social, behavioral, and psychological domains of functioning. As Coronavirus variants mutate and evolve, adherence to guidelines such as social distancing and wearing masks are critical in mitigating the pandemic's detrimental effects. Previous non-causal research found significant positive associations between individual's perceptions of others' adherence to Centers for Disease Control (CDC) recommended guidelines and their own willingness to adhere (Norton, et. al, 2021). These findings suggest that witnessing social conformity plays a significant role in one's adherence during a public health crisis. The present study expands upon this research by experimentally manipulating the percentage of the population participants believe to be adhering to guidelines using doctored graphs and poll results from the CDC. We predict that because people are significantly more likely to mimic normative behaviors, viewing messages indicating a greater percentage of the population are adhering to guidelines will cause participants to increase their own willingness to adhere. Study 1 was a randomized between-subjects design with one independent variable and four levels. Each image depicted different levels of mask adherence (i.e., 40%, 70% and 100%) and an empty city control. Study 2 was a randomized between-subjects design with one independent variable and four levels consisting of statistically doctored polls with varying levels of guideline adherence (i.e., 23%, 67%, and 92%). The National Highway Traffic Safety Administration graph served as the control. We will conduct a one-way ANOVA on the results of both studies. For Study 1, we expect that guideline adherence will be higher in conditions showing more masking. For Study 2, we also predict that guideline adherence will increase in conditions showing a higher percentage of the public adhering to guidelines.

An Analysis of Yasser Arafat's 1976 Speech to the UN General Assembly

Annalise Webber
Dr. Meredith Scott
United States Air Force Academy

In 1974, Yasser Arafat addressed the United Nations General Assembly. As head of the Palestine Liberation Organization (PLO), Arafat approached the council and advocated for peace, stating that he wanted an end to the conflict tearing apart his country. This presentation will provide historical context for understanding the Arab-Israeli conflict and examine specific events in the year leading up to Arafat's speech and why they are important context for Arafat's speech. In addition, it will consider why those events were important influences on his address. Finally, it will analyze Arafat's words and evaluate the motives for his famous speech. He needed to explain why the PLO rejected the UN's partitioned state solution while also diverting attention from the violence that Palestinians committed in response to Israeli strike, seeking the General Assembly's sympathy. Furthermore, Arafat called for peace to further gain sympathy and build credibility with the General Assembly. His call for peace, however, was a thinly veiled threat, with the intention of forcing the General Assembly to give the PLO what they wanted.

Oral Session 2

1:30-3:00

Issues in Security
Room A217

Women's Role in Counterterrorism and Counterextremism

Lauren Brashear
Dr. Lynne Chandler-Garcia
United States Air Force Academy

One of the most significant ongoing foreign policy issues that the United States faces is counterterrorism. Defending the homeland and punishing rogue actors are important pillars of Grand Strategy, so dealing with terrorists and extremists should be valued and the United States should be using all available resources and strategies in order to best counter these actors. However, the United States seems to underestimate an important actor in both perpetrating and preventing terrorism, women. Although there have been small steps in growing women's role in counterterrorism, women are still not being engaged enough in combatting terrorism and extremism, and they are underrepresented in security and other roles. Women and girls are often targets of terrorist organizations, through abductions, rape, and trafficking, examples of this include Boko Haram kidnapping girls in Nigeria and the Taliban attacking girls in Afghanistan and Pakistan. Women are not only targets, but also have a role as perpetrators and recruiters. Because of this, women can play an important role in predicting and preventing terrorism, in that they can predict early signs since they are early targets, and they have influence in youth populations and with other women. In regards to counterterrorism, women's role is underestimated and they are underrepresented, so more funding, more recruitment, and more incorporation should be done by the United States to combat terrorism and extremism.

North Korean Nuclear Proliferation

Blake Bautch
Dr. Lynne Chandler-Garcia
United States Air Force Academy

Before North Korea renews its resolve to develop nuclear missiles capable of reaching U.S. mainland, the U.S. must take an unprecedented, aggressive, and threatening stance against Kim-Jong-Un's regime. Negotiations between the Trump administration and Kim-Jong-Un failed to yield significant North Korean concessions due to a lack of credible, threatening U.S. threats. The liberal security approach of the previous administrations has continued to fail to coerce North Korea nuclear and missile tests, therefore, the U.S. needs to shift to a stronger realist security approach with the intent of creating a security dilemma for Kim-Jong-Un. The dilemma must no longer be for North Korea to cease nuclear proliferation or face sanctions, but rather to cease nuclear proliferation or face harsh internal and external military, political, and soft-power pressure. The policy I am proposing consists of a two-pronged approach to coercing Kim-Jong-Un to cease nuclear and missile testing: provide internal pressure via information and influencing campaigns and provide external pressure by openly denouncing Kim's nuclear developments, threatening the use of covert military force, and increasing international pressure in violation of North Korea's anti-leaflet laws. Ensuring the stability of the Korean Peninsula is of utmost importance to the United States. The U.S. must take renewed decisive action against the Kim regime in order to force Kim in line so that the U.S. can focus its resources on its peer great power threats such as Russia and China. Additionally, the U.S. has a principle interest in protecting the security of its South Korean allies, as well as disarming a nuclear threat to the homeland.

Why Nations Abandon Conscription

Jonathan Farrell
John Gould
Colorado College

The world's militaries are currently undergoing a structural shift in response to a change in military purpose. Since 1970 the number of recorded nations not employing a conscription-based recruitment model has risen from 20% to 55% in 2009. This paper engages scholars' political, social, and economic reasoning for this reformation in a case study comparing India and South Korea. The existing academic arguments of removal of external threat, proliferation of military alliances and economic factors contradict the reality observed in South Korea and India as each determinant should have led to South Korea adopting AVF and India maintaining a conscription force. The opposite of what is true. Instead, this rise of all-volunteer-forces is a response to the evolving function of militaries as tools to respond to overseas terrorism and smaller conflicts. Military policymakers recognize the need to change outdated military structures and envision a smaller, elite, long-term, technologically superior force.

American Foreign Military Strategy Against China

Charles Erwin
Lynne Chandler-Garcia
United States Air Force Academy

The United States has held a western hegemon for the past few decades, however, starting around the early to mid-2000s, military power and influence has arisen in the east. China has become one of the fastest growing economies in the past two decades, and with that, has brought greater military might and technologies that threaten the United States' status in worldly military affairs. Given that China has amassed the largest standing army in the world alongside developing air, land, and sea capabilities similar to that of the U.S., there is a rising fear of what may become of China's military in the next decade or so, however, it is their growing nuclear arsenal (only around 200) and superior development of hypersonic technologies that has the U.S. most concerned. In order to combat this issue, the U.S. should continue on with the national strategy of deterrence through punishment in order to help suspend Chinese aggression and military progression, while also furthering our advancements in hypersonic technologies in order to at the least meet Chinese capabilities if current methods fail to hold within the next decade. To support this conclusion or find another solution, I will be researching current and future Chinese/American military developments and look at what is said by experts in such fields in order to determine whether this is truly the optimal strategy in combating China's military growth and encroachment on our hegemon.

Healing – *Virtual Presentations* Room A221

Healing through the Power of Play

Kyanne Doubleday
Robin Schofield
Pikes Peak Community College

When children have experienced trauma, immediate intervention needs to be taken so the healing process can begin. With resources like play therapy children, with several types of traumas, at different ages and with diverse backgrounds, can begin to reach a level of trust and understanding that is not normally needed other methods, such as adult talk therapy. Researchers have found that the act of play is already a way for children to express their feelings, process emotions and communicate. By applying play to a therapeutic setting children are approached in ways that they understand. Many techniques of play therapy are offered to children who have gone through trauma like puppets, playing with a sand tray, writing letters, and making art. Play therapy has been up for criticism and comes with many critics but if children begin to open up emotionally, become vulnerable and begin to heal then play therapy needs to be discussed and explored more. Children are the future and deserve to have the resources available with the statistics to back up play therapy, so that they too can live fuller happier lives.

Animal Adoption - Why it is Important

Brooklyn Garcia
Robin Schofeild

Pikes Peak Community College

Animal adoption has always been viewed as a gray area when it comes to buying a pet. What if the animal has a bad temperament? Since it's not a puppy it won't get to grow up with me and will be harder to train. What if they just don't have the animal I want? All of these are questions many of us think of before buying an animal from anywhere, but they specifically come into play when adopting an animal.

First Responder Mental Health

Daniel Grodman
Robin Schofield
Pikes Peak Community College

First responder mental health is a topic that is not touched on a lot in society today. With EMS providers, firefighters, and police officers dealing with different forms of trauma every day, they are at higher risk of suicidal ideation, attempts, and completion than the general public. In 2017, it was reported that firefighters and police officers died by suicide more often than in the line of duty. The numbers showed that 103 firefighters and 140 police officers died by suicide, while 93 firefighters and 129 police officers died in the line of duty. Providing first responders with more resources for better mental health must be high on our priority list. Reforming the way they are trained and allowing them to receive counseling for themselves and their families are just some of the ways we can help. If nobody takes care of our first responders in their time of need, who will take care of us in ours?

Cultural Biases Room A222

A Post Racial-America

Joseph Logan
Glenn Rohlfing
Pikes Peak Community College

The reason for this data and research study is to explore the relationships between finance education, diversity, and equity among various ethnicities. Characteristics of learning, comprehension, ideology, education, equity, and career are the main strategies approached in the data collected. The results are collected from a survey on Diversity, Equity, Inclusion. Academic resources are also used to discuss post racism ideology, where we are at as a community regarding diversity, equity, and inclusion. The

differences in ethnic functioning in education, society and finance are subtopics of the data analyzed. The analyses were conducted on demographics, ethnicity, and finance.

Women's Sphere and Visual Culture: Imagery of the American Suffrage Movement

Abigail Kopetzky

Roy Jo Sartin

University of Colorado Colorado Springs

The last two decades of the women's suffrage movement (1900-1920) coincided with an increase in women's admittance into art schools and the "golden age" of postcards. The resulting proliferation of pro-suffrage cartoons and postcards voiced women's arguments for suffrage and countered anti-suffrage arguments. Historians have devoted little research to women's political cartoons, so my research adds to the limited conversation on women's art creation during this pivotal time in women's history. The prevailing understanding of gender roles, held by prospective suffragists, voting men, and politicians, shaped the imagery and themes utilized by suffrage artists. Through the analysis of anti- and pro-suffrage imagery I will illustrate the common arguments utilized including liberal feminism for justice, how women's abilities are suited to voting, and using the vote to improve society.

Sexualization of the Pharaohs: Fetishization of Egypt's Queens

Rowan Hight

Roy Jo Sartin

University of Colorado Colorado Springs

The oversexualization of female pharaohs in twenty-first century media is not often discussed. Many different forms of media, including television and music videos, sexualize not only pharaohs but most of the Egyptian women they portray. The image of a powerful seductress draped in finery and surrounded by symbols of Egypt is not unfamiliar to many people. Because of films such as *Cleopatra* (1963) that depict female pharaohs in this manner, the mystical enchantress is a prevailing image for pharaohs such as Cleopatra and Neferneferuaten, more commonly known as Nefertiti. However, this portrayal of female pharaohs comes from an orientalist ideology about Egypt passed down from antiquity. Roman authors constructed a false image of Egypt as a land of mysticism and magic but established that it was foreign and, because of this, that it was beneath Rome. The combination of mysticism, femininity, and sexuality in reference to Egyptian pharaohs perpetuates sexist views of powerful women by fetishizing their culture and, by extension, the women themselves. Although many Americans and Europeans are exposed to media about female pharaohs, these pharaohs are portrayed through an orientalist lens that serves to spread misinformation about the nature of their power as rulers. This paper uses ancient sources such as Plutarch's account of Cleopatra and Cassius Dio's *Roman History* to establish the history of orientalism regarding Egypt and her queens. It also brings in more modern sources such as Katy Perry's "Dark Horse" video, *Cleopatra* (1963), and *The Mummy* (1999). Through comparing these examples to sources from ancient Egypt this paper explores one aspect of the orientalist fetishization of Egypt.

Experience of Culture Room A226

Clausen Books Documentary

Joanna Gonzalez

DeLyn Martineau

University of Colorado Colorado Springs

My computer mouse hovered over two options prior to purchasing a book online: Digital or Physical Copy. I opted for digital versions of books historically, but I suddenly recalled the delight of turning pages. The bending and folding. The coffee stains, scribbles, and rips. That smell wafted into your face as you rapidly flip through the chapters. I ditched the digital and opened a secret bookcase door. Behind it was an unanticipated story and though my research has not been concluded, I must share what I have discovered thus far. This documentary is about local bookstore owner Doug Clausen and his collection of books. It explores what impact digital books have on his collection and what the future may hold for the bookstore and its' printed books.

An Objective Look at the Nature and Necessity of Music Theory

Cameron Stark

DeLyn Martineau, Andrew LaBasi

University of Colorado Colorado Springs

Having never been one to dabble in mysticism: I believe that there is a logical explanation for even the most paranormal or seemingly unexplainable, and I live my life in firm adherence to that ideology. Inspiration found me last autumn, in my Rhetoric and Writing class. I found a new musical calling that I could have never dreamed of having to fortune to stumble upon: Scientifically defining accepted musical doctrine of all types. Many things about this excited me, but the main attraction to this work was its ability to prune what I believe to be pathogenic attitudes towards the creation of music that proudly brandish a belief system built at its core around mysticism. Music, like every other industry, is just that: an industry. While artistic freedoms and shared happiness among humans are certainly positive consequences, the true goal of the music industry is to make money. People throwing logical thought by the wayside when creating music will have one unfortunately convenient outcome: It will oil the musical engine and thus increase profitability. More completed songs can be made faster when the people making them surrender their musical dignity and use premade chord files to build songs like Lego. There is no fundamental understanding of the various theories that make these songs sound good, and in exchange, an actual rejection of music theory has become a largely accepted approach to music production. But here's the catch: these songs and musical ideas created with assembling chords adhere to known musical theory... Perfectly. So, while I know that I will not change anything about how modern music is produced, I will take great satisfaction in taking a stab at mysticism and its intrusion into the musical word.

Fan Narratives Surrounding Closed Attractions in the Disney Theme Park Fandom

April Chizanskos

Roy Jo Sartin

University of Colorado Colorado Springs

It is well known that Disney as a brand has fans and that the Disney theme parks have fans, but there is also a specific community within the wider Disney theme park fan community that focuses on attractions with the parks that have since closed. Current academic research surrounding the Disney theme parks focuses on the implications of the parks' design, namely the Disney brand's selling of ideologies in the park, and the attempt to engender a positive view of the brand onto visitors. However, current research around the Disney theme park fan community is missing study around how fans discuss and mourn shut down attractions in the parks. Using the fandom study theories surrounding emotional connection, and the creation of fan community narratives, I will be using online interactions between fans, such as forum posts and online comments, to show how fans talk about these rides, and how they interact with each other when discussing attractions that have closed. I aim to show how fans create community-wide narratives surrounding the Disney theme parks, what these narratives are, and how those narratives in turn affect how fans view closed attractions. I hope to show that fans create narratives within the fandom space in order to establish a stronger, more cohesive sense of community.

The benefits of play:

Why we should let children communicate in a language they can all understand

Gabrielle Lopez

Kendra Mull

Pikes Peak Community College

While there has been extensive research regarding the importance of teaching children academic skills, many of them are not able to retain the information that they learn or they do, but then forget. This is why it's important to allow them to explore these skills in a way they can all understand and that is play. Play benefits children in many ways. As an Early Childhood Education student, I never had realized how important it was. I would always assume that children played and weren't learning academic skills. The reality is, children are learning skills such as science, mathematics, language, and even socio-emotional skills. These are heavily researched skills. These were even researched by the developers of child psychology including Vygotsky, Piaget, Montessori, and Freud. Their research concluded that play is beneficial. So instead of trying to make schedules that preschoolers need to rigorously follow, we should instead allow them to play for as long as they would like to. This has proven to be beneficial, so why should we hold it back?

Human Wellness: Psychedelics & Meditation

Room A253

Claviceps purpurea

Samaya Singleton, Sam Velazquez, Ken Williams
Jennifer Wawrzonek
Pikes Peak Community College

The purpose is to investigate *Claviceps purpurea* effects when ingested by humans. Deeper exploration of chemical makeup and how it effects the human body, brief history of *Claviceps purpurea* in human history, and the current research being conducted on the derivatives from this fungus will be conducted. The scientific name of this ergot fungus is *Claviceps purpurea* that grows on ears of rye, cereal, and foraging plants. Consumption of contaminated grains and seeds can lead to ergotism that can affect both the circulatory and neurologic systems of humans. Historical records show ties of *Claviceps purpurea* to events like St. Anthony's Fire and the Salem Witch Trials. Data collection for this research project will be obtained through careful literature review. Understanding the implications to human health from *Claviceps purpurea* contamination provides better understanding of the health implications that can arise from contaminated foods. Additionally, investigating the com that can be taken from this fungus and further isolated or manipulated can potentially lead to new breakthroughs in medicine and human health.

Toxic Shock and Menstrual Health

Olivia Orahod
Erin Almand
United States Air Force Academy

Menstrual Toxic Shock Syndrome (mTSS) is an uncommon but severe disease caused by Toxic Shock Toxin-1 producing *Staphylococcus aureus* in the vaginal canal. Historical data concluded tampon use, especially high absorbency tampon use, is a major cause of mTSS, while case studies and retroactive reports identified additional risk factors influencing TSST-1 production and disease onset. Of these risk factors, oxygen content within the vaginal canal and elevated vaginal pH proved to be the driving forces behind TSST-1 production. However, while research exists on the role of environmental factors, the interplay between menstrual products and these factors is less well-understood. This study examined anaerobic and aerobic *S. aureus* growth and toxin production over 24 hours, using an enzyme-linked immunosorbent assay. Preliminary aerobic data suggest a peak in toxin production around 4 hours, with another potential peak as late as 12 hours. Based on these results and tampon use recommendations, time points of 4 and 8 hours were chosen for further analysis to determine the interplay of pH and anaerobic conditions. Additional insight into this relationship may identify interactions critical to minimizing toxin production and maintaining safe menstrual health habits.

**Mental Wellbeing of PPCC Community through SKY Happiness Retreat
(Recorded Presentation)**

Paudel, Puja
Glenn Rohlfing and Ilah Jackson
Pikes Peak Community College

Due to the pandemic and its impact on mental health, Phi Theta Kappa (PTK) team realized the importance of bringing a wellness workshop to Pikes Peak Community College (PPCC), which would provide access to various stress release techniques to students, faculty, and staff. PTK, Alpha Gamma Alpha chapter collaborated with SKY Campus Happiness and hosted two retreats for the PPCC community. SKY Campus Happiness is a total well-being and resilience training tailored for college students, staff, and faculty around the globe. The SKY Happiness Retreat offered by SKY Campus Happiness features interactive group processes, experiential learning, emotional intelligence training, evidence-based SKY Breath Meditation, yoga, leadership and service. We had 72 students, faculty, and staff join the SKY Happiness Retreat. The students, staff, and faculty all had amazing sharings and feedback regarding the retreat and the majority share that they feel energized, connected with oneself and others. This experience of partnering with the community college and national service organizations gave me the confidence to take on this responsibility and allowed me to explore my leadership potential, leading with empathy and applying organizational management, ultimately securing a grant for service projects.

**Military & Society
Room A255**

**De-Ba'athification:
The American Policy Based on an Assumption of Guilt**

Haley Jones
Colonel Paul Gillespie
United States Air Force Academy

The American military has been engaged in its longest hot war, known as the Global War on Terror. For the last twenty years, US troops have been deployed to combat global terrorism and instill western, democratic values to the Middle East region. To fight radicalism in Iraq, American policy-makers implemented "De-Ba'athification" after the successful 2003 invasion. De-Ba'athification removed members of the Iraqi Ba'ath Party and left a deadly power vacuum in its place. The party's removal by the United States left the nation's government, economy, and military dismantled. The destructive aftermath of the policy shifted the US into a defensive stance, which took an additional eight years of counterinsurgency operations for the American military to combat. Without urgent attention to the failures of De-Ba'athification, America may find itself in a similar situation in the future. The failed

diplomatic efforts in 2003 Iraq must not be repeated; the American military lost 4,431 soldiers and spent \$757.8 billion trying to undo the effects of the policy. This research aims to comprehensively understand the American policy and its faults, all of which lead to the prolonged US presence in the nation, and will identify the major shortcomings of de-Ba'athification. It will elucidate de-Ba'athification's origins, objectives, implementation and finally its aftermath. The presentation will highlight interviews, government documents and books to obtain empirical information on this policy. Finally, further study will show that the policy was fundamentally at fault by assuming all members of the Ba'ath Party were as evil as its oppressive leader, Saddam Hussein. However, association with the party was the only way to get and keep any government jobs, including service in the military, since the 1960s. Therefore, by indiscriminately removing all 400,000 members of the party working in the government, Iraq could no longer function as a state.

**An Uphill Battle:
The Integration of Women into the United States Military and Service Academies**

Hoffmeister, Haley Hoffmeister
Dr. Brian Laslie
United States Air Force Academy

Throughout history, women consistently contributed or held some role in the United States' wartime effort and military conflicts. Women served in unofficial capacities until 1901 when the military willingly employed women as civilians. However, with the onset of World War I, military service needed to adapt. With the breakthrough of civilian women flying for the military, various organizations and individuals began to fight against gender norms and discrimination to provide women with the opportunity to serve. President Harry S. Truman signed the Women's Armed Services Integration Act into law in 1948, which formally allowed women in active duty. In March 1972, congressional debates began on the Equal Rights Amendment to address the possibility of women at military service academies. After continued debates, the bill reached President Gerald Ford, who signed the Department of Defense Appropriation Authorization Act into law on 7 October 1975. Individuals across the country displayed continuous opposition to the inclusion of women after the decisions from congressional litigation. The transformation of female experiences, representation, and recognition in the military is a direct result of decades worth of activism following the ratification of the Nineteenth Amendment. However, gender inequality still exists in the U.S. military. All combat positions, including ground forces, only opened to women in January 2013. While the U.S. military remains one of America's most progressive institutions, it is still necessary to encourage the participation of women in the military and ensure their experiences/opportunities are equitable to their male counterparts.

The war with Russia and its Direct Effects on the Economy

Yusuf Khan
Tahira Ahmad
Pikes Peak Community College

My main purpose is mainly to inform people what can happen if we go into a war with Russia. I am personally interested in learning how the business cycle can be affected by the actions of congress: involving the US economy in foreign affairs. This is something I believe is very important to learn as the economy can take a hit from a war which in turn effects everyone's life. I would love to teach people the importance of economics and how just learning a brief amount of economics can change your life and allow you to be prepared for any changes in the business cycle.

Humanities Room A259

The Morality of Don Quijote

Latsis, Elizabeth Latsis
Dr. Ismenia De Souza
United States Air Force Academy

Hace más que cuatrocientos años, un hombre nombrado Miguel de Cervantes decidió escribir una sátira de las caballerías de España, y por una consecuencia involuntaria, escribió uno de los libros más influyentes en la historia del ser humano. La historia es más que un cuento sobre un loco que imagina que es un caballero, más que una combinación de todos los estilos de la literatura, y más que un resumen de la situación actual de España. Es la historia de un hombre que quiere más que todo encontrar un propósito en su vida, que se lleva al punto de la manía. Don Quijote de La Mancha encapsula la esencia del ser humano, el malvado, el bueno, todas las emociones, las intenciones, la hipocresía, y las motivaciones. Tras la perspectiva de un hombre loco, Miguel de Cervantes crea un mundo en lo cual el lector se conecta con su imaginación y con la pureza del ser humano. Debido a la manera en que Don Quijote como un personaje captura la necesidad humana de sentirse importante, en que la historia inspira la imaginación, y en que el lector se siente la profundidad de las emociones, Don Quijote de La Mancha tiene su fama. El propósito del trabajo es analizar las motivaciones y valores de Don Quijote en sus aventuras para mostrar como su carácter hace que Don Quijote de La Mancha es un libro tan famoso.

Un análisis de la representación de la iglesia católica desde de la percepción y perspectivas del protagonista Lázaro en la obra obra La vida de Lazarillo de Tormes y de sus fortunas y adversidades.

Renee Montaz
Dr. Ismenia De Souza
United States Air Force Academy

Se ha escrito mucho sobre el poder y la influencia de la iglesia católica en España. En realidad, a través de la literatura se puede ver millares de trabajos sobre el papel de la iglesia y, en algunos casos sobre la hipocresía, la corrupción y los abusos de la iglesia en España. Sin embargo, se hace falta un análisis detallado de la representación de la iglesia desde de la percepción y los ojos del protagonista Lázaro en la obra La vida de Lazarillo de Tormes y de sus fortunas y adversidades. En este papel, se analizará en particular las experiencias y abusos que sufre Lázaro bajo la tutela de los amos: el clérigo, el Fraile de la Merced, el buldero, el capellán y el arcipreste. Por fin, se analizará las influencias negativas en la vida de Lázaro y, la falta de la enseñanza de los valores morales y religiosos por parte de los amos de Lázaro.

The Use and Effects of Romanticism in the Poetry of José Martí

Allison Langenburg
Dr. Ismenia De Souza
United States Air Force Academy

This paper analyze how the poet and revolucionary used romanticismo in his writing both to express his own tragic story and to rouse patriotic sentiment in Cuba during a time of revolution. Martí wrote in a time of great social upheaval in Latin America, when many countries began to reject the colonization of the conquistadores and reinvigorate their national identity. While controversial, José Martí roused the nation and incited public fury with his strong patriotism and anti-Spanish sentiment, as expressed in the poems Poema XXV and Dos Patrias. Still, the man was more than the ideals he fought for, as evidenced by Martí's heartbroken and sentimental poems Yo Soy un Hombre Sincero and Cultivo una Rosa Blanca. This paper will analyze the style and devices used in both the personal and revolutionary poems of José Martí, and how these common methods are effective in conveying both messages.

**An analysis of the Spanish perspective on the subject of death in Coplas
by the death of the master of Santiago Don Rodrigo Manrique**

Adam Broshkevitch
Dr. Ismenia De Souza
United States Air Force Academy

Much has been written on the subject of death, however, an analysis of the Spanish perspective is needed as regards the issue of death and the legacy of each one when dying. Human beings wonder, what happens when a person dies? What will be my legacy as I leave? The writer tries to answer some of those questions in Coplas for the death of the master of Santiago Don Rodrigo. In addition, the writer shows us some Spanish perspectives on the subject of death and Spanish culture. Jorge Manrique shows us through Ubi sunt, and other literary devices such as personification and metaphors to form his characteristic of death and the legacy of each person at death. Therefore, the purpose of this work is to analyze the Spanish

perspectives on death and how they are reflected in the family values of the Spaniards. Finally, the treatment of the elderly, interpersonal relationships between the family and the attitude towards individual independence will also be analyzed.

Military Strategic Studies Room A260a

The Iran Nuclear Deal

Abigail Allgauer

Dr. Lynne Chandler-Garcia

United States Air Force Academy

The Iran Nuclear Deal, also called the Joint Comprehensive Plan of Action established in 2015, was a plan to limit Iran's nuclear activities to prevent them from developing nuclear weapons. Recently, there has been discovery of enriched uranium up to 60% which is enriched way beyond the enrichment level required for use regarding nuclear energy (typically 3-5%). The Iran Nuclear Deal was supposed to limit their enrichment level to 3.67%, no higher. This is a major foreign policy issue because with higher grade uranium, it would be very easy for Iran to create nuclear warheads and develop nuclear weapons, especially with aid from Russia. Due to the consistent violations Iran has made, JCPOA needs to be revised, a new treaty needs to be put in place, and Iran needs to be reprimanded. If Iran keeps violating the treaties in place without repercussions, proliferation could possibly be a problem throughout other nations seeking nuclear weapons as well.

K-Pop Soft Power:

How the South Korean Government Rides the Hallyu Wave

Mary Black

Dr. Brent Talbot (primary), Dr. Sara Castro

United States Air Force Academy

In the 1990s, political scientist Joseph Nye contended that both those who coerce and those who can inspire and attract can garner power in the international system. The latter form of influence is known as "soft power." The Korean or "Hallyu" Wave has without question inspired and attracted global attention through its distinctive and viral-worthy art, brands, and media. Notably, the Korean Pop or "K-Pop" music genre has galvanized a global, dedicated fanbase that routinely brings their favorite stars to the forefront of music charts, social media trends, and oftentimes mainstream media. This raises the question: Does the South Korean government treat K-Pop as a soft power? This essay captures why K-Pop qualifies as a soft power, arguing that the South Korean government promotes the successes and international popularity thereof. In doing so, South Korea shows they are striving for independence and preeminence

in the economic, diplomatic, and cultural spheres. While overall successful in generating economic prosperity and even some diplomatic legitimacy, the Korean government has had limited success in using K-Pop to achieve regional political aims. This essay will seek to uncover the message of some government-sponsored K-Pop initiatives and their implications, both on South Korea's prospects and on the international system. Furthermore, it will draw conclusions on the validity of the K-Pop soft power model and the potential for other countries to replicate such a model.

The City of Heroes: The Image of Mariupol in Post-Maidan Ukraine

Daniil Tourashev
Dr. Nicholas Kupensky
United States Air Force Academy

While much of Donbas fell under separatists' control in 2014, Mariupol became one of the only major cities to successfully overthrow its pro-Russian groups and remain part of Ukraine. Since Mariupol proved able to resist separatist activity, Ukrainian popular opinion of the city changed favorably in recent years. No longer viewed as a polluted, economically declining, regional hub, Mariupol now evokes feelings of bravery and patriotism among Ukrainians. However, initially, it was not the case. Some, including the Russian administration, thought Mariupol would willingly change their national alliance to follow in suit with much of the Donbas region. The reason came down to the almost 50% Russian-speaking population of the city, which, if appealed to properly, could be compelled to rise against the city's government. For instance, Rinat Akhmetov, the most influential individual in eastern Ukraine, backed the Russian separatists in Donetsk, signifying he would likely do the same in Mariupol. The city's economic decline and nostalgia for the Soviet rule, could have inspired many residents to seek a better life by casting their lots with modern Russia. However, not only did Mariupol reject the separatists' intentions, but it became a symbol of Ukraine's broader fight against Russia's destabilizing role after the Revolution of Dignity. In my presentation, I will argue that Mariupol's unique combination of factors allowed it to become the place that helped turn the tide of the war: history, geography, oligarch power, civil society, and the role of National and International Aid.

Radioactivity & Energy

Room A261

The Spectroscopy of Radioactive Xenon Using Atom Trap Trace Analysis of Products of Protests

Piper Gray, Jonathan Soferr
Dr. Michael Shaffer & Dr. Monte Anderson
United States Air Force Academy

Radioactive Xenon isotopes do not occur naturally except in extremely low abundance. They are, however, a common by product of anthropogenic nuclear fission events, and therefore their presence can be taken as evidence of nuclear detonations. This project examines the use of atom trap and trace analysis for measuring the proportion of radioactive Xenon isotopes to stable Xenon in an air sample to determine whether a nuclear detonation has occurred. Xenon and its radioactive isotopes are common by products of all three major types of nuclear weapons. Using laser cooling and trapping technologies, individual atoms of radioactive Xenon will be optically trapped whereby emitting photons as they relax from the excited state to the ground state. The laser frequency at which Xenon atoms are trapped and begin to fluoresce is unique to each specific isotope and will be used to identify the atoms contained in a sample. The laser frequencies which will trap the radioactive isotopes of Xenon have not yet been experimentally determined. This project is aimed at determining these values using laser spectroscopy by scanning the trapping laser across a range of frequencies until fluorescence from the trapped atoms is detected and measured. We will report on the progress and findings of the ongoing experimental effort.

Radiation Trapping in Alkali Atoms

Ryan Dinndorf, Samuel Karlson
Dr. Monte Anderson, Dr. Brian Patterson, Capt Anita Dunsmore, Lt Col Robert Vincent
United States Air Force Academy

We used a Monte Carlo computer algorithm to simulate the effects of radiation trapping in a potassium vapor cell with nitrogen and helium buffer gases. Understanding the effects of radiation trapping is important in applications such as the creation of gas lasers or the validation of atomic models. For example, the impacts of radiation trapping are significant when scaling diode-pumped alkali lasers (DPAL) to high powers. Simulations were made for buffer gas pressures as high as 1000 torr and cell temperatures as high as 200°C. A variety of cell geometries was studied. We used experimental data to validate our simulations. In the experiment, a femtosecond laser pulse excited potassium atoms along the D2 absorption line and the resulting fluorescence was observed as a function of time. An exponential fit of these points determined the excited state lifetime. A comparison of the statistical model and experimental results will be discussed.

The Falcon Solid-state Energetic Electron Detector (SEED) Measurements of the 14-145 keV Electrons in the Geosynchronous Environment

Griffin Levi

Dr. Matthew G. Mcharg, Dr. John D. Williams and Dr. Richard L. Balthazor
United Air Force Academy

The Space Physics and Atmospheric Research Center at the United States Air Force Academy operates the Falcon Solid-state Energetic Electron Detector (SEED) on the Space Test Program Satellite-3 (STP-3) in geosynchronous environment. The Falcon SEED is an energetic charged particle sensor that monitors electron flux across the energy range of 14-145 keV. It also measures total exposure to ionizing radiation from a dosimeter and an internal temperature reading. The payload started transmitting on 15 January 2022. In this paper we compare the overlapping electron flux data to other synergetic payloads on STP-6, Air Force Research Lab's Compact Environmental Anomaly Sensor (CEASE) and the National Nuclear Security Administration's Space and Atmospheric Burst Reporting System (SBRS). Additionally we compare the experimental data from SEED to the European Space Agency's theoretical Space Environment Information System (SPENVIS) model as well as National Aeronautics and Space Administration's AE-8 electron model environment. Finally, we compare SEED's low energy electron data to the National Oceanic and Atmospheric Administration's GOES-16 satellite's Magnetospheric Electron Detector (MAGED) low energy election data on a different satellite in a similar environment. We found that the electron flux data was accurate. With the confirmation of our Falcon SEED data, we can begin to analyze and understand the low energy electron data of the geosynchronous environment.

Microorganisms: Infection & Disinfection Room C200

Giardia Zoonotic Infection and Transmission

Aspen Chambon, Inga Fabriciusa
Jennifer Wawrzonek
Pikes Peak Community College

E. coli and Staphylococcus Aureus are two types of bacteria commonly found, that although are mostly harmless, contain a few strains that have a possibility of causing illness. While both of these types of bacteria contribute a multitude of health related issues one difference between the two is their gram stain positivity. Over a period of forty eight hours various disinfectants, household and name brand, were applied on these bacteria to test overall resistance to everyday cleaning products through growth in a controlled environment. This presentation aims to educate on the effects of gram positive and negative bacteria and their resistance to these everyday cleaning agents. The results conclude whether or not gram stain affects the overall resistance to these cleaning agents and clarifies which agents are the most effective.

Bioengineering of a Haloalkane dehalogenase for the Bioremediation of Perfluorinated Compounds

Madison Fox
Dr. James M. Kovacs
University of Colorado Colorado Springs

High levels of toxic contamination of perfluorinated compounds, PFCs, found in the Southern Colorado Springs Metro Area have been measured in drinking water and degraded in organisms found originating at Peterson Air Force Base, one of approximately 2,000 Department of Defense known chemical spill sites. They have been known to cause significant health effects such as affecting fetal growth and development, cancer, and injury to vital organs in exposed populations. PFCs are both long-lived and toxic, and limited governmental resources for impact investigation make the proposed work both urgent and of inherently high impact to the citizenry of southern Colorado. Methods such as filtration and carbon sorption are ineffective and expensive, so alternative methods are needed to remove them. Here we propose a method of bioremediation to defluorinate PFCs using enzymes bioengineered to degrade per-fluorinated compounds. This method is a better alternative than the previously proposed methods since the enzyme works to remove the fluorine atoms, as fluoride ions, from the compound. This makes degradation more efficient and better for the environment rather than re-locating the toxic compound to another site, which would thus increase the total amount of PFC contamination. A haloalkane dehalogenase protein from a marine Rhodobacteracea was expressed using standard bacteriological protein expression. The enzyme was then purified using affinity chromatography, purity was monitored using FPLC and SDS-Page gels. We are currently modifying known dehalogenation assays to measure the inherent de-fluorination of our enzyme before testing optimized enzymes. Our next steps begin by modeling the active site to drive the bioengineering of the enzyme by locating and identifying important amino acids for mutagenesis.

Per- and Polyfluorinated Alkyl Substances alter fungal morphologies in *Penicillium* sp. and *Fusarium* sp.

Eamon McHugh
Dr. Erin Almand and Dr. J. Jordan Steel
United States Air Force Academy

Perfluorinated alkyl substances (PFAS) have been infiltrating the environment for over seven decades. The effects of these highly thermodynamically stable chemicals are often presented as having many negative medical effects on humans to include cancer. While understanding the human effects, it is also important to understand the ecological effects PFAS chemicals could be having on the large array of ecosystems in which PFAS are found. This study demonstrates the morphological effects that PFAS, specifically Perfluorooctanoic acid (PFOA), has on two particular fungi: *Penicillium* sp. and *Fusarium* sp. Both of these fungal genera are found across the world and have a significant effect on the ecosystems in which they are present. Using different PFOA gradients in varying growth environments, PFOA was shown to limit pigment production and limit growth morphology in *Penicillium* sp. and *Fusarium* sp. The mechanism for interaction between the fungi and PFOA is not currently known but the fungal growth in high concentrations of PFOA suggest possible mycoremediation applications and PFAS cleanup in the future.

Gram Positive / Gram Negative Bacteria Versus Household and Name Brand Disinfectants

Joseph Ponce de Leon, Alvin Syquia, Hero Vernon
Jennifer Wawrzonek
Pikes Peak Community College

E. coli and Staphylococcus Aureus are two types of bacteria commonly found, that although are mostly harmless, contain a few strains that have a possibility of causing illness. While both of these types of bacteria contribute a multitude of health related issues one difference between the two is their gram stain positivity. Over a period of forty eight hours various disinfectants, household and name brand, were applied on these bacteria to test overall resistance to everyday cleaning products through growth in a controlled environment. This presentation aims to educate on the effects of gram positive and negative bacteria and their resistance to these everyday cleaning agents. The results conclude whether or not gram stain affects the overall resistance to these cleaning agents and clarifies which agents are the most effective.