CSU PUEBLO

Spring Research Symposium 2025: Celebrating 20 Years of HSI

Friday, April 4, 2025

8:00a.m. – 4:00 p.m.

Oral & Poster Presentations

LINC in the LARC

THANK YOU!

To CSU STRATA and the Office of the Provost for funding the catering for the 11th Annual Spring Symposium. Your generosity is much appreciated!

Dear Symposium Attendee,

Welcome to the 11th annual Celebration of Research, Scholarship, and Creative Activities at CSU Pueblo! It is an honor to continue celebrating the incredible work of our students and the dedication of our faculty mentors who guide them through their academic and creative endeavors.

This event showcases the diverse and innovative projects that allow our students to apply classroom learning in meaningful ways while sharing their passion and knowledge with the campus and broader community. Experiential learning remains at the heart of our mission, as we strive to develop student-centered strategies that align with the evolving needs of our region. Today, we recognize and celebrate student achievements while also highlighting the invaluable mentorship our faculty provide. Their commitment to fostering creativity, intellectual growth, and professional skills exemplifies CSU Pueblo's guiding principles of building knowledge, empowering students, transforming learning, and developing people.

As you explore the Symposium, you will witness firsthand the remarkable talent and dedication of our students. Their work is a testament to their hard work, curiosity, and perseverance, as well as to the support and guidance of our outstanding faculty members.

While we eagerly anticipate participation numbers for this year, we know that our students and faculty will once again bring an inspiring array of presentations representing all of CSU Pueblo's schools and colleges. Congratulations to all students for their commitment to research and creative expression, and to the faculty mentors who embody the teacher-scholar model that defines the exceptional education at CSU Pueblo.

On behalf of the College and School deans and Academic Affairs leadership, I extend my gratitude to all participants for their dedication and enthusiasm. I hope you find this year's event both rewarding and inspiring. Enjoy the Symposium!

Best Wishes,

Gail Mackin, Ph.D.
Provost and Executive Vice President for Academic Affairs
Colorado State University Pueblo

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College of Science, Technology, Engineering and Mathematics

Nutritional Health and Well-Being of CSU Pueblo Student-Athletes: A Mixed-Methods Study

Authors: John Strait, Zoey Paris, Rylie Nash, Molly Charles, Aaron Krinsky, Erica Crouch, Genna Cortinas, Hope Edgecomb, Dylan Viebrantz-Zavatini, Michaela Santistevan, Madison Doverspike, Thifany Castro

Faculty Mentor: Dr. Tina Twilleger

Associations: Arts and Creative Media, Athletic Training, Exercise Science, Health Science, Nursing

Abstract:

Purpose

The purpose of this study is to assess whether CSU Pueblo's student-athlete population is receiving adequate nutrition and, if not, to identify changes that can be implemented to improve their nutritional health and well-being. This study will utilize a mixed-methods approach to gather both quantitative and qualitative data from student-athletes competing in soccer, wrestling, baseball, softball, and volleyball.

Methods

A mixed-methods approach will be used to analyze CSU Pueblo student-athletes' nutritional intake, eating habits, and overall dietary well-being. Quantitative data has been collected from 119 survey responses, assessing dietary habits, caloric intake, meal timing, and access to proper nutrition.

To further explore the experiences and challenges related to nutrition among student-athletes, focus groups will be implemented in Fall 2024. These sessions will provide qualitative insights into athletes' personal experiences with nutrition, barriers to proper fueling, and potential solutions to improve dietary habits. The focus groups will specifically engage athletes from soccer, wrestling, baseball, softball, and volleyball, ensuring representation across a range of sports with varying energy demands and nutritional needs.

Additionally, Cooking Matters classes, organized by Care and Share and taught by Discover Scholars, were conducted in Spring 2023-2024 in CSU Pueblo dormitories to provide nutritional education to students. Data collection from these classes is ongoing.

Results

The quantitative data collected through the surveys will provide statistical insights into student-athletes' dietary habits, meal frequency, caloric intake, and nutritional deficiencies. The qualitative data, gathered through focus groups, will offer deeper perspectives on the challenges

athletes face in maintaining proper nutrition and the structural barriers within CSU Pueblo's dining services.

Preliminary findings indicate that a majority of student-athletes struggle with consuming adequate calories daily and frequently skip breakfast due to limited dining hours at Pack Café. The focus groups will explore how these limitations impact athletic performance, recovery, and overall well-being while gathering athlete-driven recommendations for improvements.

Photoluminescent Properties of Lead-Free Metal Halides

Authors: Dylan Retzloff

Faculty Mentors: Dr. Max Wallace

Associations: Chemistry

Abstract:

The monoclinic double perovskite derivative A2InCl5·H2O (where A = Cs+) is attracting attention as luminescent phosphors because of its high quantum yield and adjustable luminescent properties. This study aims to explore how using Mn2+ as the dopant, affects the structure and luminescent properties of these materials. Mn2+ doped Cs-In-Cl structures were synthesized using hydrothermal and precipitation reaction techniques. The samples were characterized by powder X-ray diffraction, scanning electron microscopy (SEM-EDS), and photoluminescence measurements. Future efforts will be focused on synthesizing the non-hydrated structure.

Structural and Luminescent Properties of Sb3+ doped K2InCl5:H2O and Non-hydrated K3InCl6 Phosphors: A Comparative Study with Rb+ and Cs+ Analogs

Authors: Alice BlackBear

Faculty Mentors: Maxwell Wallace (Dr. Wallace)

Associations: Chemistry

Abstract:

Sb3+ doped monoclinic double perovskite derivative A2InCl5:H2O and the non-hydrated A3InCl6 (where A = Rb+ and Cs+) have attracted attention as luminescent phosphors because of their high quantum yield and adjustable luminescent properties. However, there are no known reports on Sb3+ doped K2InCl5 ··H2O or K3InCl6. This study aims to explore how the smaller K+K+ion, compared to Rb+ and Cs+, affects the structure and luminescent properties of these materials. Sb3+ doped K-In-Cl structures were synthesized using hydrothermal and microwave techniques. The samples were characterized by powder X-ray diffraction, scanning electron microscopy (SEM-EDS), and photoluminescence measurements. Preliminary results indicate a mixed-phase structure was formed that emitted a yellow-green color under UV light. Future efforts will be focused on synthetically preparing each of the proposed structures individually.

Electrophilic Fluorination of Electron-rich Aromatics: Phenols, Anisole, and Phenolic Esters

Authors: Nick Goffar, Isabella Hewitt, Dakota Matznick, Dr. David Dillon, Dr. Melvin Druelinger

Faculty Mentors:

Associations: Department of Chemistry

Abstract:

In continuing explorations of the electrophilic fluorination of electron-rich aromatics with Selectfluor (F-TEDA BF_4), a recent focus has been on phenol, resorcinol and related compounds. The major products are the 2- and 4- monofluoro substitutions as well as small amounts of the 2,4-difluoro substitution products. The most reactive compounds studied are phenols followed by anisoles. The least reactive class of compounds are phenolic esters. Small amounts of oxidized fluorocyclohexadienones have also been found in the product mixtures. This is because the reagent is both a good electrophilic fluorine source and also a powerful oxidizer. The reactions have been studied in different solvents (CH3CN and H2O) and subjected to both thermal and microwave reaction techniques. Solventless mechanochemical techniques were attempted with two solid reactants, however they did not yield very promising results.

Cloning and Isolation of Phage Sheen Genes of Interest

Authors: Nick Goffar, Nico Macdonald, Christopher Hall, Ian Thomas

Faculty Mentors: Dr. Amaya Garcia Costas

Associations: Biology, Biochemistry, Cannabis Biology and Chemistry

Abstract:

Phages play a crucial role in biotechnology and microbial ecology as viruses that infect bacteria. A majority of Phage genes have unknown functions, understanding their genetic composition can reveal useful functions with wider applications. In this study we describe the cloning and isolation of Phage Sheen genes using molecular cloning techniques. This research contributes to the broader understanding of phage genetics and provides a guide for the identification and characterization of phage sheen genes.

Divergent synthesis of Cannabidiol (CBD) metabolites using functional intermediates

Authors: Daniel C. Rogers, Chico Ryder, Noah Reid, Aja L. Jaquez

Faculty Mentors: Samuel N. Gockel, Ph.D.

Associations: Cannabis Biology

Abstract:

Metabolites of cannabidiol (CBD) are an understudied class of medicinally important cannabinoids. Complex legalities and regulations in the United States have largely hindered the ability to conduct important research into these compounds. When introduced into the human body, CBD undergoes extensive metabolism to produce over 140 metabolites. To date, only two of these have been produced on sufficient scales to enable further applied studies (Figure 1). Our study aims to synthesize the non-developed metabolites through a diversity-oriented de novo approach that will furnish access to a wide range of the target metabolites. This is completed through the synthesis of a family of nucleophiles, along with the synthesis of a monoterpenoid, bifunctional building block intermediate (Figure 2). While a de novo convergent synthesis has been performed along with the synthetic route using CBD as a starting material in previous studies, this study proposes new synthetic routes to construct the nucleophilic and monoterpenoid intermediate components. Friedel-Crafts alkylation provides the pathway for the conjoining reaction of the synthesized building block and respective nucleophiles. Following successful achievement of the target metabolites, their biological activity will be compared to that of the parent compound (CBD). This will elucidate potential medical applications and strongly contribute to the science concerning the interactions of CBD in the human body. Along with this, environmental applications will be studied through an investigation of the Fountain Creek watershed to understand how cannabinoid materials might build up in groundwater systems. Current results involve successful production of several nucleophiles, along with five steps in the synthesis of the bifunctional intermediate with characterization confirmed through spectral analysis.

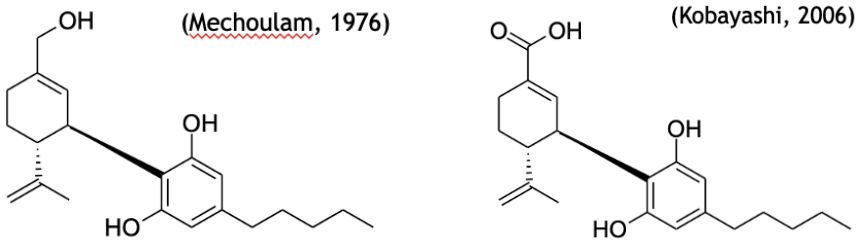


Figure 1. Metabolites previously synthesized, which also represent the major class of CBD metabolites (right) and the minor class of metabolites (left).

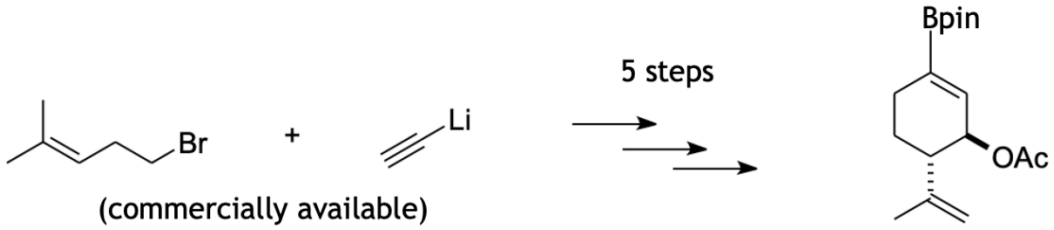


Figure 2. Summarized synthetic route of bifunctional building block intermediate.

Large Octocopter Cockpit and Controller Design

Authors: Pedro Arrieta, Tim Penn, Samuel Alamos, and Juan Flores

Faculty Mentors: Drs. Nebojsa Jaksic and Trung Duong

Associations: School of Engineering

Abstract:

In recent years, the demand for everyday transportation has grown, and the development of multicopter drones has shown promising advancements. The Octocopter MAPS research project focuses on creating an atypical 8-propeller Electrical Vertical Takeoff and Landing (eVTOL) with a frame made out of aluminum. The mass of the drone is just over 50kg, but it can theoretically create enough lift to carry a 100 kg payload which exceeds the mass of an average adult male (90 kg). Previous research was aimed towards redesigning the cockpit and controller of the drone with the expectation to reduce vibrations in the hardware allowing the drone a more stable flight. Current research builds on this goal with the added challenges of remaking the base to accommodate for a potential passenger (the width of the cockpit is currently just over 24 in), and implementing foldable arms that would allow for the drone to fit comfortably in a standard 9 feet by 18 feet parking space. The research team has been working on creating a linear actuator which can have many different applications like an automatic door for the drone. To this end, a major focus of research has been the setup and calibration of the 3D printer space in the engineering CIM lab which will be used to support various engineering research projects including the MAPS octocopter.

EYA2 inhibition leads to decreased MYC in MYC high Osteosarcoma

Authors: Alicia Ortega, Ryota Shira, Avery Bodlak, Sydney Meyer, Masanori Hayashi

Associations: Biology

Abstract:

Osteosarcoma (OS) is the most prevalent bone cancer in children and adolescents, with survival rates of 70% for the localized disease but only 20% for metastatic or recurrent OS. The protein EYA2, implicated in cancer progression, is overexpressed in OS, and siRNA-mediated repression of EYA2 has shown promise in reducing OS cell migration and invasion, though its mechanisms remain unclear. MYC, a protein associated with poor outcomes in OS, is known to be regulated by EYA proteins in other cancers, suggesting a potential interaction in OS. This study investigates the role of EYA2 in regulating MYC expression and its impact on OS cell behavior Using PCR-based mycoplasma detection and western blotting, OS cell lines with high MYC and EYA2 expression were selected. EYA2 knockdown (KD) was achieved in 143B, U2OS, and CHCO-OS1 cells through lentiviral shRNA vectors, and the effects of EYA2 KD on MYC expression, cell proliferation, clonogenicity, and migration were assessed. Results showed that EYA2 KD reduced MYC expression and inhibited migration and proliferation in 143B and CHCO-OS1 cells, both of which exhibit high MYC and EYA2 levels. These findings suggest that EYA2 regulates MYC expression and influences OS cell behavior, highlighting EYA2 as a potential therapeutic target. Future studies will focus on elucidating the mechanisms underlying EYA2's regulation of MYC and investigating the effects of EYA2 depletion on OS metastasis and survival in vivo.

Assay development to understand the activity of DBF under physiological conditions

Authors: Anastasia Valdez, Madison Gutierrez, Alicia Ortega and Rikayla Quezada

Faculty Mentors: Dr. Cassidy Dobson

Associations: Biochemistry

Abstract:

Disulfide Bond Forming Enzyme (DBF) is a molecular chaperone that has been shown to act like a disulfide isomerase. However, DBF possesses no cysteine residues, making its mechanism of disulfide rearrangement unique. We are interested in elucidating this mechanism but also seek to understand the activity of DBF under physiological conditions, including temperature. DBF is from a known thermophile and previously has had maximum activity at 50°C, but it remains elusive how its activity levels compare at 37°C. We have been using lysozyme as a model system to measure its activity after renaturation in the presence of DBF at 37°C. We hope to develop a robust and reproducible assay to measure DBF activity that can then be applied to a variety of DBF mutants to understand which amino acids are responsible for its unique activity and therefore its disulfide rearrangement mechanism.

Disulfide mediated aggregates of γ-crystallins - can DBF help?

Authors: Brithany Garces1, Madison Gutierrez1, Rosely Gonzalez1 & Rikayla Queszada1

Faculty Mentors: Dr. Cassidy Dobson

Associations: MAPS, Department of Chemistry

Abstract:

Protein misfolding disorders such as cataracts, amyotrophic lateral sclerosis (ALS), Huntington's disease (HD), and other neurodegenerative diseases can occur due to disulfide-mediated aggregation. In cataracts, gamma crystallin aggregation is primarily responsible and can be induced by intermolecular disulfide bonds. We aim to investigate the generation of disulfide-mediated aggregates of γ-D and γ-S crystallin in order to see if these aggregates can be reversed or prevented by the molecular chaperone Disulfide Bond Forming Enzyme (DBF). SDS-PAGE is qualitatively used to assess initial aggregation in the presence and absencof DBF followed by the introduction of chemical oxidizers such as copper(II), oxidized glutathione, and cystine. The ability of DBF to prevent or reverse these disulfide-mediated aggregates will then be further investigated by more quantitative means in hopes to understand the mechanism of action of this chaperone.

Identification of cytotoxic genes in Mycobacterium smegmatis phage Sheen

Authors: Names: Rosely Gonzalez1, Xelzin Becerril - Hernandez1, Rishav Basyal1, and Erubiel Dominguez-Pina1

Faculty Mentors: Dr. Amaya Garcia Costas

Associations: Department of Biology1

Abstract:

Bacteriophages (or phages) are viruses that infect and replicate within bacteria. They are the most abundant biological entities on Earth (1031 particles). Analysis of many bacteriophage genomes has shown many genes with no known function. For example, in the study of mycobacteriophages, over 100,000 genes among the 2,000 sequenced mycobacteriophages are of unknown function. Mycobacterium smegmatis phage Sheen has 52,927 base pairs and 84 genes, of which 44% of its genes have no known function. This allows for exploration of its genes and their function, leading us to ask the question: what genes found in M. smegmatis phage Sheen are determined as cytotoxic genes? In this experiment, M. smegmatis phage Sheen genes were assigned to be isolated, purified, and cloned. The genes of interest were the following: 6, 15, 10, 16, 17, 55, 56, 57, 67, 73, 75, and 79. To determine the cytotoxicity, how toxic the gene is to the host's cell, of these genes, they were inserted in M. smegmatis. Out of the 12 genes, 11 were transformed in E. coli. 4 out of the 11 genes were clone-verified. Future steps include cytotoxic assay in M. smegmatis to identify cytotoxic genes.

Effects of a native pollinator garden on hummingbird abundance compared to other landscapes

Authors: Sadie Kovtynovich1,2, Jake Powers1,2,3, and Claire Ramos1,2,3

Faculty Mentors: Dr. Claire Ramos

Associations: 1Department of Biology, Colorado State University – Pueblo, Pueblo CO ; 2CUATRO ; 3MAPS

Abstract:

Hummingbirds, which are essential for the pollination of plants with elongated tubular corollas, are experiencing population declines that are driven by habitat loss and human disturbance. Supporting hummingbird populations can be achieved by planting a variety of native flowering species that provide natural nectar sources throughout the growing season. Using native plants as an alternative to artificial feeders offers a more sustainable food supply and helps maintain local ecosystems supporting other local pollinators in the process. My research investigated the relationship between plant diversity and hummingbird abundance at CSU-Pueblo by comparing a pollinator garden, traditional landscaping, and native habitat areas. We predicted that a pollinator garden, designed with a variety of flowering plants specifically selected to attract pollinators, could support higher hummingbird visitation compared to a native plant area. Observations were conducted three times a week during peak feeding times over the course of a summer season, where the frequency of hummingbird visits to each site and what plants they were feeding on were recorded. The diversity and abundance of flowering plants at each location was assessed to explore their impact on hummingbird visitation patterns. We found that the pollinator garden supported the highest abundance of hummingbirds, with notable numbers observed throughout the summer, while fewer visits were recorded in other areas. It was found that hummingbirds predominantly visited the pollinator garden where there were many different types of flowers with elongated corollas. In addition, the diversity and abundance of flowering plants at each location were assessed to explore their impact on hummingbird visitation patterns. This research provides insights into how plant selection can enhance pollinator conservation efforts, landscape remediation, and agricultural processes.

Effects of CBD On Intracellular Calcium Homeostasis in Human Neural Cells

Authors: Brandon Blanchard, Xavier Hatch, Alex Benavidez, Lauren Olivares, Alexandria Sanchez

Faculty Mentor: Jeffrey Smith, PhD.

Associations: Biology, Cannabis Biology and Chemistry

Abstract:

In this study, our aim was to determine the effect of Cannabidiol (CBD) on intracellular calcium ($[Ca^{2+}]_i$) homeostasis in cultured neurons. This is important since neuronal calcium homeostasis is foundational to the mechanisms of a wide variety of neural functions relevant to both health and disease including neurotransmission, cell migration, differentiation, survival and biochemical signaling. Previous research with mixed primary brain cell cultures from rats have demonstrated CBD-dependent elevation of cytosolic calcium which appears to involve roles for both transmembrane calcium fluxes as well as the release of calcium from intracellular storage organelles, however, discreet mechanisms have not been well elucidated. Therefore, we employed dynamic cytosolic calcium imaging of living SH-SY5Y cells, a human-derived neuroblastoma cell line commonly used as a model for neuronal function and differentiation, to evaluate the effect of acute application of CBD on $[Ca^{2+}]_i$. CBD elicited a small but measurable $[Ca^{2+}]_i$ response which was transient in some responding cells but continued to rise slowly in other cells. Furthermore, cells that were treated with CBD, when compared to vehicle controls, showed a reduced $[Ca^{2+}]_i$ response to elevated extracellular potassium levels, a treatment known to induce calcium influx via the activation of voltage dependent calcium channels which reside in the plasma membrane. This is interesting because it supports a direct role for CBD in influencing a fundamental effector of calcium homeostasis in human neurons and has strong implications for understanding how CBD can affect basic neuronal functions including neurotransmitter secretion and patterns of excitability involved in information processing. It is also interesting because it illuminates a novel pathway for CBD to enhance the well-established mechanism by which THC is known to inhibit neurotransmission and the synaptic plasticity central to learning and memory. This latter observation is in contrast to literature which proposes CBD to be an antagonist of THC and indicates a clear direction for more mechanistic research to follow.

Cloning Phage Sheen Genes Into Plasmid pExTra To Generate a Purified Plasmid Stock: Genes 39, 50, 61, 63, 64, and 83

Authors: Kristina Kizewski, Jessica Veith, Jacob Rodriguez, Amaya Garcia-Costas

Faculty Mentors: Dr. Amaya Garcia-Costas

Associations: Biology Department, Colorado State University Pueblo

Abstract:

A significant issue in the medical field today is antimicrobial resistance. When individuals succumb to an infection or develop a sickness, many hospitals and clinics issue antibiotics to combat illnesses. Over time, infectious bacterial cells can become resistant to antibiotics, making it difficult for medical providers to efficiently treat illnesses caused by microbes. One way to combat this rising issue in the medical field is with bacteriophage, viruses that infect bacteria. These phages are host-specific, meaning they target certain strains of bacteria; therefore, bacteriophage replicate by inserting their own DNA into a specific bacterium in order to replicate themselves, causing the bacterium to burst after bacteriophage replication. In this aspect, a phage can be used to eradicate certain bacterial strains in the human body without affecting the host. This strategy can be applied in a medical setting to combat antimicrobial resistance. However, many phage species are still unidentified today, with many students and community members working to discover more phages in the environment. This study focuses on the bacteriophage Sheen, which targets mycobacterial cells. Specifically, this study involves isolating specific genes within the phage Sheen's genome to fully investigate the capabilities this phage possesses. Specific genes 39, 50, 61, 63, 64, and 83 were isolated and transformed into pExTra plasmids. Verified clones can be transferred into a stock solution to be used in cytotoxicity assays to determine how efficient these genes are at causing cell death. Over time, the entire phage's genome will be investigated to provide an overall deeper understanding of this phage and its functions.

Methodology and proteomics analysis of Manduca sexta regarding low and high lead concentrations found in native plants on the Pueblo Colorado Superfund Site

Authors: Kristina Kizewski, Moussa Diawara, Amaya Garcia-Costas

Faculty Mentors: Rick Farrer and Jim Carsella

Associations: Biology and Chemistry

Abstract:

The current study examines the gut microbiome's response to lead exposure to the tobacco hornworm Manduca sexta and its potential links to cancer development. The caterpillars were exposed to lead concentrations matching levels found near a Superfund site in Pueblo, Colorado, with varying exposure groups (high, medium, and low lead concentrations). The exposure levels were chosen to mimic the lead levels found in the lants at the superfund site, confluence site, Pueblo Reservoir and Clear Creek Ranch sites. The control was just the normal prepared diet for the caterpillars. The study employed metal uptake analysis (EPA methods 3052 and 6020b) to measure lead concentrations in the caterpillars. Statistical significance ($p<0.05$) was found between groups, with major differences in lead concentrations across experimental groups. Proteomics analysis of frass (insect droppings) was conducted, particularly comparing high and low lead exposure groups to investigate changes in gut protein expression. The results indicate alterations in the microbiome and gut protein expression of the caterpillars exposed to higher lead concentrations. Future work includes expanding proteomics analysis to include the control and medium lead exposure groups, as well as further statistical analysis to explore microbiome changes across the experimental groups.

Characterizing the Structure and Function of the ParB-like Nuclease in Actinophage Prairie

Authors: Maia Rice

Faculty Mentors: Dr. Amaya Garcia Costas

Associations: Biology

Abstract:

Bacteriophages, also known as phages, are viruses that infect only bacteria and are some of the most abundant entities on Earth. Phages have become research targets for various applications in therapeutics, the food industry, water treatment, and more. Bacteriophage genome analyses have shown that many of the open reading frames in phage genomes have an unknown or poorly-characterized function. We have identified one such gene in Actinophage Prairie that codes for a ParB-like nuclease. We have used AlphaFold3 to show that the structure of this protein is similar to the ParB-like nuclease found in the bacterium Myxococcus xanthus, which has been shown to be a CTP-dependent regulator. We hypothesize that the ParB-like nuclease in Prairie has a similar mechanism and regulatory function than this M. xanthus protein. Here we present a bioinformatic and biochemical investigation of this ParB-like nuclease in phage Prairie to further elucidate its function.

Particle Size Distribution and Consistency Analysis of Recycled Grated Plastics for Asphalt Mixtures

Authors: Caio Oliveira1, Edmond King1, Christopher Beascochea1, Dr. Hasan Faisal1, Leo Mcclelland1, Chris Wasinski3, Adam Farmer3, and Dr. Rashad Islam1,2

Faculty Mentors: Dr. Leonardo Bedoya-Valencia

Associations: 1School of Engineering, Colorado State University Pueblo, USA, Southern Colorado Institute of Transportation Technology (SCITT), Colorado State University Pueblo, 3Driven Plastic, Pueblo, CO.

Abstract:

With only 5–6% of plastic recycled in the U.S., low recycling rates and declining plastic quality hinder sustainability, demanding urgent innovation and global commitment. This study analyzes the gradation distribution of the most recent recycled plastic samples from Pueblo, Colorado, on an innovative idea of reusing plastic and minimizing the environmental impact of this material incrementing recycled plastic in asphalt mixtures. Sieve analysis reveals that most particles are within mid-range sizes, primarily in the #8, #16, and #30 sieves, which account for over 80% of the material retained. This concentration suggests a consistent particle profile, with minimal presence of extremely fine or coarse particles. Frequency analysis reinforces this finding, highlighting a predominant distribution in mid-sized particles. Probability density analysis also indicates a predictable distribution pattern, demonstrating consistency across the sample set. This reliable particle size profile, with uniform distribution across samples, points to the grated plastic's stability in terms of composition. Such findings are valuable for understanding how recycled plastics could be quality-controlled and standardized, providing insight into the material's properties and variability limits, which can inform specific industrial applications where controlled particle size is crucial. These results underscore the importance of particle size distribution in determining the suitability of recycled materials for precise engineering requirements.

Keywords: Particle size distribution, recycled plastics, sieve analysis, frequency analysis, probability density, material consistency, standard deviation

Melt Flow Index Analysis of Recycled Plastics for Sustainable Asphalt Applications

Authors: Authors: Christopher Beascochea1, Edmond King1, Caio Oliveira1, Dr. Hasan Faisal1, Chris Wacinski3, Adam Farmer3, Dr. Rashad Islam1,2 and Dr. Sylvester Kalevela1

Faculty Mentors: Drs. Nebojsa Jaksic and Trung Duong

Associations: School of Engineering

Abstract:

This study investigates the potential of using recycled plastics from various companies in Pueblo, Colorado, focusing on the Melt Flow Index (MFI) and Melt Flow Rate (MFR) through the testing of samples in an Extrusion Plastometer. Analyzing processed samples of recycled Low-Density Polyethylene (LDPE) from companies like T.R. Toppers, CMC, FUJI and others, the study assessed plastic types based on the Melt Flow Rate to further understand their potential applications as asphalt additives. The MFI values collected for several samples ranged from 0.26 to 1.50 grams/10 minutes after being subjected to a standard temperature of 190° C, closely simulating the temperatures at which asphalt is typically poured at (135 to 150° C). These MFI values indicate the presence of low-viscosity thermoplastic polymers. These polymers exhibit qualities of having a high molecular weight, potentially increasing the durability and long-term performance of asphalt mixes. While the extrusion plastometer is new to Driven Plastics and data collection/analysis is still ongoing, current results suggest that polymers with a lower MFI have a higher viscosity compared to polymers with high MFIs. Recycled LDPEs with a high MFI could be favored to be used in asphalt design mixes as the lower viscosity ensures effective dispersion through air voids within the poured asphalt and reduce clumping, theoretically enhancing the bonding of the design mix and improving long-term performance. This research contributes to the development of sustainable asphalt mixes by utilizing recycled plastics in our roads and highways to reduce environmental waste. While MFR and MFI are important factors in the determination of which recycled LPDEs are more effective in asphalt mixes, other aspects such as asphalt performance, polymer compatibility, and the potential for material degradation inside these mixes must also be considered. This study highlights the importance of understanding the viscosity of polyethylene at high temperatures when considering recycled plastics for widespread implementation in hot-mix asphalt designs.

Keywords: Recycled plastics, Melt Flow Rate, Melt Flow Index, viscosity, polyethylene, high molecular weight, sustainability, industrial repurposing, material consistency, Pueblo Colorado, plastic waste management

Comparative Analysis of Aging on Cannabis sativa L. Seed-Viability via Dehydrogenase Activity

Authors: Chaylen Richards, Ingrid Carolina Corredor-Perilla, Ryu Byeong Ryeol

Faculty Mentors: Dr. Sang-Hyuck Park

Associations: Cannabis Biology and Chemistry

Abstract:

Cannabis sativa L. has long been valued for seed oil production, with proper harvesting and storage playing a crucial role in maintaining seed viability. However, germination rates are highly sensitive to storage conditions such as temperature, moisture, light, and duration. While these factors are well-documented, their collective impact on seed viability remains a key area of study. This study examines the effects of aging on key signaling pathways in C. sativa seeds using a tetrazolium viability assay to assess dehydrogenase enzyme activity. Respiring tissues reduce colorless 2,3,5-triphenyl tetrazolium chloride to formazan, a red-colored compound, through dehydrogenase-catalyzed reactions, making this assay a reliable indicator of enzymatic activity. Cannabis seeds harvested in Colorado during the years 2019, 2022, and 2023 were presoaked for 24 hours, after which their embryos were excised and incubated in a 1% tetrazolium solution at 30°C for six hours. Embryos were then qualitatively evaluated for the intensity and total area of red coloration, indicating enzymatic activity. Additionally, seed morphometry and germination rates were analyzed and compared to enzymatic activity. Morphometric analysis revealed that 2019 seeds had significantly greater average length, width, and mass (length: 4.6 ± 0.1 mm, width: 3.3 ± 0.1 mm, mass: 19.8 ± 0.1 mg) compared to the 2022 and 2023 groups ($n = 50$, $P < 0.05$). Germination rates differed significantly, with seeds from 2022 (59.00%) and 2023 (52.25%) showing higher viability than those from 2019 (12.00%) ($n = 80$, $P < 0.05$). Dehydrogenase activity, as indicated by red coloration, was highest in 2023 seeds (~90% coverage; n=100) and lowest in 2019 seeds (~65% coverage; n=100). These findings suggest that seed aging reduces dehydrogenase activity, impairing germination by limiting essential enzymes for growth signaling. Future research should explore improved storage methods to mitigate seed quality degradation.

Evaluating Body Condition and Apparent Survival in Migratory Songbirds

Authors: Kelsey Crona

Faculty Mentors: Dr. Claire Ramos

Associations: CSU Pueblo Biology, MAPS,

Abstract:

Little research has been done on the direct impacts of climate change on the fitness of birds during migration periods. While body condition measurements are a common tool used by ornithologists to assess the individual fitness of birds, these health indicators have yet to be correlated with survival during migration. We predict birds in poor condition will have lower apparent survival during migration. We also predict that migrating birds will have lower apparent survival during extreme drought and air pollution from wildfire driven by climate change. Using Cellular Tracking Technologies Hybrid Tags, we tagged six migratory songbirds in the fall of 2024, four of which have been detected by the Motus network. A total of 100 tags will be deployed by spring migration of 2026. Findings from this research will help understand the accuracy of using body condition measurements to predict survival as well as the impacts of climate change on songbirds during migration.

Amphibian Superhighways: Does proximity to the Arkansas River and Fountain Creek influence amphibian diversity and species composition in Southeast Colorado?

Authors: Jules Golz1-3, Lee Bartosz1-2, Joey Holubek1,3, Nohealani Cowans1,3, Seth Bozzi1,3, Adrienne Luna1,4, Samuel Lund1,4, Daryl R. Trumbo1-4

Faculty Mentors:

Associations:

Department of Biology, Creating Connected College Research Communities (CUATRO) Program, Mentoring Access & Platforms in STEM (MAPS) Program, Discovery Scholars Program

Abstract:

Colorado is home to a variety of amphibians, featuring 18 species across 6 families of class Amphibia. Due to their permeable skin and aquatic larval stages, amphibians rely on accessible waterbodies in their environments to survive. They may also be limited in their dispersal (non-migratory movements) to areas connected by reliable, year-round flowing waterways. Two of the largest, permanent waterways in Southeast Colorado are the Arkansas River and Fountain Creek. We hypothesized these 2 waterways may act as 'amphibian superhighways,' allowing amphibians to disperse and establish greater species diversity near these systems. Species data were collected March-October of 2023 & 2024 in the evening and nighttime during peak breeding and activity periods. Surveys focused on suitable breeding sites (small lakes, ponds, creeks, & wetlands) identified using aerial photos and Google Maps Terrain. Auditory cues of frog calls and visual cues like eyeshine reflected from spotlights were used to identify species. Survey data were compiled in QGIS to calculate distance in meters from either of the 2 waterways. Each site's distance and species diversity were analyzed using ANOVA and Spearman's correlation tests in R Studio. We found a total of 8 species representing 5 families of Amphibia in and around these waterways in Southeast Colorado. Species diversity was not significantly associated with proximity to the 2 major watersheds ($p=0.07$). Plains leopard frogs were located in closest proximity to major waterways ($\mu=1,332$ m), followed by boreal chorus frogs and bullfrogs, while Mexican spadefoot toads were located farthest away ($\mu=4,790$ m). Amphibians are often considered 'bioindicator species,' given their sensitivity to aquatic pollutants, and their high ecological value as both predators of aquatic and terrestrial insects and prey for other wetlands species. Therefore, high amphibian diversity close to the Arkansas River and Fountain Creek may reflect high water quality and healthy wetland ecosystems.

Effects of Sonication in Cannabis Sativa L. on Germination Percentage and Early Growth

Authors: Eamonn Miller

Faculty Mentors: Dr. Sang-Hyuck Park

Associations: Cannabis Biology and Chemistry

Abstract:

Cannabis sativa L. is cultivated commercially for use in a wide variety of industries including textiles, foods, medicines, and manufacturing. Cannabis producers frequently report low germination percentage for the seeds they buy/use. The cost of cannabis seeds is high compared to most other commercial crops. Seed treatments are being investigated as a cost-effective way to increase germination percentage in Cannabis sativa L. The primary purpose of this investigation was to test sonication as a seed treatment in Cannabis sativa L. The investigation was preformed by submerging seeds for various intervals (0, 1, 4, 16, and 64 minutes) in a sonication bath filled with deionized water. Statistics were prepared using a one-way ANOVA with Tukey's post-hoc analysis. Results showed an increase in germination percentage up to 18% (64 min) compared to control. Preliminary results indicate that the development of a sonication device and procedure for commercial Cannabis sativa L. cultivation applications would be financially beneficial to cultivators.

Recombination of E.coli with Superoxide Dismutase from Candidatus Chloroacidobacterium

Authors: Alissa Egle

Faculty Mentors: Dr. Amaya Garcia Costas, Alissa N. Egle

Associations: Engineering

Abstract:

Thermophilic bacteria present in microbial mats of the Octopus Hot Spring in Yellowstone National Park possess a variety of biological properties to sustain life in the hot, alkali, and oxygen-rich environment of the springs. The combination of high oxygen levels and high irradiation results in a large amount of reactive oxygen species (ROS). These ROS can cause oxidative damage to the cellular biomolecules of bacteria by oxidizing proteins, lipids, and DNA. One species of bacteria found in the Octopus Springs, Candidatus Chloroacidobacterium thermophilum, has evolved several mechanisms to mitigate the effects of reactive oxygen species (ROS). It is hypothesized that this organism has a specialized superoxide dismutase (SOD) enzyme that provides this organism with increased ability to mitigate ROS damage. The genome of this bacteria has been sequenced and analyzed for specific genes that code for ROS-mitigating enzymes, including its superoxide dismutase, that allow the bacteria to survive. Here we report the cloning of SOD from Cab. thermophile in E. coli. This recombined plasmid will be further confirmed via PCR testing. Future research will involve paraquat and menadione, two enzymes that induce super oxide stress, to devise an experimental plan to test if the SOD from Cab. thermophile provides E.coli with an elevated resistance to ROS.

Do birds in poor condition remain longer at stopover sites when there is no barrier to migration?

Authors: Kieran Doolittle, Abby Hite, Claire W. Varian-Ramos

Faculty Mentors:

Associations: Wildlife and Natural Resources

Abstract:

Migration season is a very stressful time for many migratory species of birds, taking a toll on their physiological health, resulting in individuals making choices about how and when to migrate based on their physical condition. Stopover sites serve as a resting and refueling point that birds take advantage of to return themselves to a condition where they can continue their migratory journey. Most previous studies of birds at stopover sites have been conducted on either islands or peninsulas where birds are faced with a large physical barrier, such as an ocean, that encourages them to stay at these stopover sites for longer durations of time. We questioned whether birds would stay at a particular landlocked stopover site that does not precede a large physical barrier for shorter amounts of time and how their condition influences their timing in departure. The information we had gathered prior to our experiment led us to predict that birds with higher overall body condition would depart from stopover sites in less time than those who had lower overall body condition. During the spring migratory season of 2024, we tracked Swainson's Thrushes, Western Tanagers, and Green Tailed Towhees using radiotelemetry to determine the duration of their stay at a stopover site in central Colorado in relation to their overall condition. The birds were captured between sunrise and 10am with mist nets at Clear Springs Ranch. CTT hybrid tags were deployed on individuals, and we used a handheld CTT Sidekick receiver to determine when the birds had departed from the capture site as well as detections from the MOTUS network to investigate their migration progress for the remainder of the migratory period after departure from the site. We found that the body condition of Swainson's Thrushes had no significant impact on the stopover time of our study species as some birds in poor conditions left almost immediately and some birds in great condition remained at the site for multiple days. Further analysis will be conducted on the impact of weather conditions and migration seasons on the stopover time of migratory birds.

Investigating the Role of Cajal Bodies in Arabidopsis Defense Responses Through SMN-5 Mutant Characterization

Authors: Ryan Espinoza

Faculty Mentors: Dr. Mario Izaguirre-Sierra

Associations: Biology

Abstract:

The primary goal of this project is to utilize the genetic tools made available in the model plant Arabidopsis thaliana to investigate the role of Cajal bodies (CBs) in plant defense responses. Specifically, we are characterizing the SMN-5 mutant, which carries a pruned version of the Survival of Motor Neuron (SMN) gene and has been shown to affect CB formation. CBs are nuclear structures involved in RNA processing. Our research focuses on understanding how alterations in CBs influence defense pathways, particularly MAMP-triggered immunity (MTI) upon flagellin (flg22) treatment, using Arabidopsis lines including the flagellin-insensitive FLS2 mutant as a negative control. Additionally, we are exploring the role of SMN-5 in systemic acquired resistance (SAR) and its impact on susceptibility or resistance to biotic stressors. Preliminary data indicates that proper CB formation is essential for an effective defense response in A. thaliana.Preliminary data suggests CBs have significance in coordinating defense mechanisms within Arabidposis.

The effect of SMN mutations during the immune response of Arabidopsis Thaliana

Authors: Shannon Ganoe[1], Mario Izaguirre-Sierra[1]

Faculty Mentor: Mario Izaguirre-Sierra

Associations: [1]Department of Biology, Colorado State University Pueblo

Abstract:

Spinal muscular atrophy (SMA) is a fatal autosomal recessive disease, characterized by the degeneration of spinal motor neurons, and the subsequent atrophy of muscle tissue. SMA can affect many animals, including humans, mice, flies, and nematodes. In eukaryotes, a key function of SMN is the biogenesis of spliceosome components. The main mutations associated with SMA in humans occur on the survival motor neuron (SMN) genes 1 and 2. In the plant Arabidopsis thaliana, there is only one copy of the SMN gene, and importantly, similar mutations are not lethal. We performed a transcriptomic analysis to compare the expression patterns of wild type vs mutant plants and from 26,000 genes we found only 96 de-regulated genes. Interestingly some of these genes are involved in stress responses like pathogen attack. The main goal of my project is to is to take advantage of the powerful genetic tools available in the model plant Arabidopsis thaliana to understand the role(s) of SMN during defense response. Specifically, I am studying how the Pathogenesis-response 1 (PR1) gene triggers defense responses when exposed to salicylic acid in wild type and mutant plants. Additionally, we are interested in testing if SMN mutations make plants more resistant to different biotic stressors. Our preliminary data suggests that Cajal Bodies (CBs) are important in Arabidopsis defense response.

Photoluminescent Properties of Lead-Free Metal Halides: A Comparative Review

Authors: Alice BlackBear

Faculty Mentor: Dr. Max Wallace

Associations: Chemistry

Abstract:

Photoluminescent (PL) materials are actively researched in materials science and inorganic chemistry. The PL properties, such as quantum yield, luminescent decay, and peak emission wavelength, can be influenced by factors like temperature, particle size/morphology, and synthesis conditions. This presentation will focus on lead-free metal halide materials and the tunability of characteristics such as quantum yield and crystal defects. Special emphasis will be placed on comparing the properties of hydrated versus non-hydrated metal halide double perovskites.

Investigating the Role of Wildfire Smoke on Oxidative Status in Different Diet Guilds of Migratory Birds in Southern Colorado

Authors: Megan Miller

Faculty Mentors: Claire Varian-Ramos

Associations: Colorado State University-Pueblo, Department of Biology, Pueblo, Colorado, United States

Abstract:

The association between oxidative status and measures of individual fitness such as cell damage, reduced fecundity, and shortened life span make oxidative damage a valuable tool for assessing physiological impacts of wildfire smoke on avian migration. Changes in oxidative status during annual migration are often caused by increases in metabolism and/or exposure to pollutants, such as wildfire smoke. To investigate these impacts, this research is focused on how oxidative status is influenced by wildfire smoke. Air pollution exposure is predicted to increase oxidative damage while suppressing antioxidant response.

All data, including blood samples, were collected during migration-banding in the spring and fall of 2024. Blood samples were centrifuged, plasma separated, and frozen within 8 hours of capture. Hydroperoxides (oxidative stress markers) and Total Antioxidant Capacity (TAC; endogenous/exogenous antioxidants) were quantified via d-ROM and TAC assays. A 24-hour air quality station was installed at our field site, and drought index scores from the Environmental Protection Agency were used at a local and national level. If compounding climate change events like wildfire, drought, and unseasonal weather are reducing birds' ability to maintain oxidative status during migration, this could reduce overwintering survival, overall fecundity, and nest success, among other factors. This research will pinpoint species most risk to the detrimental effects of wildfire smoke and allow for more informed conservation actions.

Temperature-Responsive Luminescence in A4BB'2X12 Quadruple Perovskites: Synthesis, Characterization, and Structural Analysis

Authors: Kaylee B. Jordan

Faculty Mentors: Dr. Maxwell Wallace

Associations: Department of Chemistry

Abstract:

The recent discovery of the A4BB'2X12 quadruple perovskite structure, characterized by vacancy-ordered arrangements (A as a 1+ cation, B as a 2+ cation, B' as a 3+ cation, and X as a halide), offers a versatile platform with diverse cation and anion combinations. Vacancies are point defects in a crystal in which an atom is missing from one of the lattice points, in turn can cause unique properties. Due to this, solid-state phosphor materials emit light and are essential in material science for creating light emitting diodes (LEDs) and X-Ray detectors, etc. The growing interest in utilizing luminescent materials as temperature probes, where changes in temperature and decreasing particle size correspond to alterations in luminescent properties has recently been at the forefront of research. However, the lack of structural analysis in most related studies limits their potential. A comprehensive understanding of how temperature influences the structure, and luminescent properties of these compounds could facilitate their enhancement. Exploring other potential A4BB'2X12 quadruple perovskite cation and anion combinations and investigating how the luminescent properties are influenced by the average particle size via LARP techniques could offer exciting possibilities for manipulating the quadruple perovskite structure across various parameters. Many A4BB'2X12 quadruple perovskites have been synthesized via a solution-based method and characterized using powder X-ray diffraction (pXRD), scanning electron microscopy (SEM-EDS), and photoluminescence measurements. The synthesized structures to date were refined to be a trigonal R-3m structure. Photoluminescent properties from room temperature to liquid nitrogen temperature exhibit unique changes associated with the change in temperature, strongly influenced by the identities of cations and anions therefore its structure. This research presents exciting prospects for manipulating the quadruple perovskite structure across various parameters, offering valuable insights into how temperature affects a material's structure, morphology, and luminescent properties.

Exploring the mechanisms of resistance in UV tolerant aerobiome isolates

Authors: Margot Thomas-Gatel 1, Sei Park 2, Emily Kraus 3, Kenneth F. Reardon 2, Mark Hernandez 3,

Faculty Mentors: Pankaj Trivedi 2, Dr. Amaya Garcia Costas 1

Associations: Colorado State University Pueblo; Colorado State University; CU Boulder

Abstract:

The aerobiome is one of the least studied microbiomes on Earth, partly because obtaining reliable samples is difficult. However, the aerobiome is a source for many different extremophiles, bacteria that can survive under extreme conditions such as UV radiation, heat changes, desiccation, and more, and whose mechanisms to survive have many interesting applications. UV radiation in particular is a major environmental stressor for these bacteria that results in many types of damages at the cellular level. Moreover, UV radiation generates reactive oxygen species (ROS), which additionally disrupts many cellular processes, and damages cellular components.

Here we present the mechanistic analysis of 6 aerobiome isolates who showed high UV tolerance. To determine whether ROS resistance is a mechanism used by these isolates, they are being subjected to increasing concentrations of menadione, a chemical that induces ROS stress, and their growth rates calculated. Because other UV tolerant bacteria have shown ROS resistance, it is expected that the growth rates of the aerobiome isolates will be unaffected under the increasing menadione concentrations, or slightly reduced.

In addition, we present genomic and proteomic analyses of the aerobiome isolates that reveal additional mechanisms of resistance.

Lastly, the UV tolerance of the isolates will also be studied under aerosolized conditions, to ensure that the traits observed are replicated under relevant environmental conditions.

Association between heterophil to lymphocyte ratios and body condition in Yellow Warblers (Setophaga petechia)

Authors: Mikayla Kolln1,2, Alexis Fuller1,2, Viridiana Martinez1,2, Dr. Claire Ramos1,2

Faculty Mentors: Dr. Claire Ramos

Associations: Department of Biology, Colorado State University Pueblo, Pueblo, Colorado, USA1, Creating Connected College Research Communities (CUATRO) Program2

Abstract:

Migration is one of the most important life history stages for many species of birds worldwide. Every year, birds travel hundreds of miles each day to reach their breeding and wintering grounds. This is a very stressful event that can affect fitness and body condition. Body condition is used to estimate the energy stores of an animal. Birds with more energy stores and therefore better body condition are assumed to have increased fitness especially during challenging life phases such as migration. Birds in poor body condition may experience greater stress during migration. One way to measure stress in birds is to measure the amount of heterophils to lymphocytes in the blood. During stressful events, the birds' stress response releases an increased amount of heterophils into the bloodstream. In this study, we investigated heterophil to lymphocyte (H:L) ratios of Yellow Warblers (Setophaga petechia) during fall migration in Fountain, Colorado. Yellow Warblers are a long-distance migrant that breeds in North America and winters in Central and South America. While studies have investigated the adrenocortical response to migration in Yellow Warblers, few studies have investigated stress using H:L ratios or collected stress to body condition. Forty-six Yellow Warblers were captured via mist net, blood samples were collected, and mass, fat score, muscle measurement, and tarsus measurement were recorded. Body index was calculated using a ratio of mass and tarsus length. H:L ratios were obtained from a white blood cell count. Using a generalized linear model, we found a significant negative relationship between H:L ratios and body index, with birds with higher body indices having lower H:L ratios. These results suggest that birds in poorer body conditions may also have higher stress levels. These results suggest that H:L ratios could be used as an additional measure of avian health during migration.

Isolation and purification of phage Sheen genes

Authors: Joseph Ochoa, Mikayla Kolln, Tianna Maes, Casey Chandler

Faculty Mentors: Dr. Amaya Garcia-Costas

Associations: Biology Department, Colorado State University Pueblo

Abstract:

Bacteriophages are a type of virus that specifically infect bacteria and use them to replicate. Bacteriophages are highly specific; they can only infect a certain genus or strain of bacteria. Because of this specificity, phages are being used experimentally to combat bacterial infections in humans. This treatment is called phage therapy. Large quantities of phage genomes have been sequenced, but many of these genes have no assigned function. Sheen is a bacteriophage that infects Mycobacterium smegmatis. Sheen's genome has been fully sequenced, but function has not been assigned to each gene. M. smegmatis is often used as a model to study pathological infection and drug resistance of mycobacteria. Therefore, identifying Sheen genes that are toxic to this host could have implications on our understanding of mycobacteria and different strategies to combat infection. Here we wanted to determine which of phage Sheen's genes are involved in host death. In this experiment, we isolated, amplified and purified distinct phage Sheen genes. The gene was then inserted into plasmids and chemically transformed into E. coli. E. coli cells were selectively plated. Colonies were isolated for clone verification, DNA purification, and stock preparation. Six genes are being verified for successful cloning and six genes have been purified in stock solutions. Moving forward, we plan to conduct cytotoxic assays to determine if the cloned gene sequences are toxic to host smegmatis cells.

Photochemical dehydroxymethylative functionalization of homobenzylic alcohols

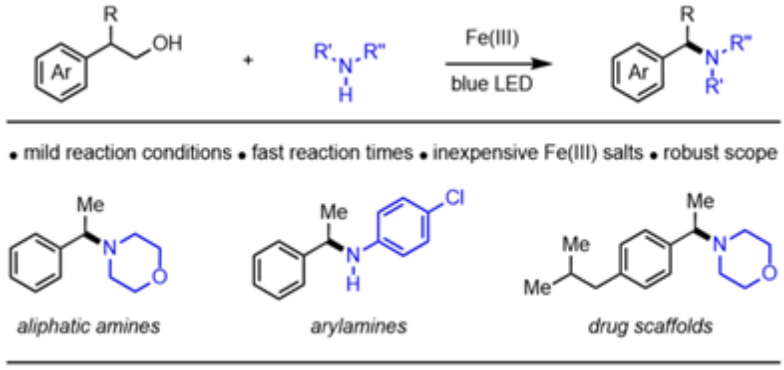
Authors: Samuel Van Hull1, Mark North1, Isabella Mobley1, Amanda Carlo1, Ian McKissick1, Jessica Spangler1, Tyler Vidmar2, Samuel N. Gockel,1 Ph.D.

Faculty Mentors

Associations: Department of Chemistry, Colorado State University Pueblo, 2200 Bonforte Blvd, Pueblo; Centennial High School, Pueblo, CO.

Abstract:

Herein, we report a photochemical dehydroxymethylative animation of homobenzylic alcohols to afford benzylic amine products. These are well represented motifs in biologically active molecules, such as antidepressants, analgesics, or anti-cancer agents. As such, the refinement and development of new methods to access these structures is of high importance. To achieve this desirable transformation, we have harnessed a photochemical approach that implicates oxygen-centered radicals and proceeds through a β-scission event. Following initial optimization on a one-pot one-step model system, we have pivoted our studies to investigate a one-pot two-step protocol, which affords cleaner chemoselectivity and higher chemical yield. The scope of the transformation is currently under evaluation, and our initial investigations have indicated that a wide variety of functional groups, and steric and electronic perturbations are tolerated. Current mechanistic insight provides evidence for the intermediacy of open-shell radical species. Future work will entail further study of the mechanism of this novel transformation and a complete evaluation of its scope and limitations.



Effects of Cannabidiol (CBD) on the health and gut microbiome of Manduca sexta.

Authors: Shannon Robinson

Faculty Mentors: Dr. Amaya M Garcia-Costas

Associations: Biology

Abstract:

Insects can have transient microbiomes or resident microbiomes. These microbiomes interact with their host and play a key role in digestion and detoxification, and under some circumstances can also harm the insect. We are investigating the detoxifying role of transient microbiomes, given their short residence time in the gut. To do this, we will test a plant toxin, cannabidiol (CBD), on tobacco hornworms. Tobacco hornworms are a common pest found throughout the United States and in neighboring continents and islands. They feed on nightshade family plants, decimating common crops. Due to their short life cycle and ease of care, tobacco hornworms are model organisms for caterpillar and moth studies, especially in agricultural-related research. Our chosen toxin, CBD, is a secondary metabolite found in Cannabis sativa commonly known as the hemp plant, and is believed to be part of the plant's defense against pests. Previous research has shown that after being exposed to CBD, tobacco hornworms have a high failure rate shedding their exuvia causing them to die. I hypothesize that Manduca sexta's gut bacteria might play a role in detoxification or changes in physiology during this CBD exposure by either metabolizing and altering CBD or changing their metabolism thus impacting their health. To investigate these potential roles of the gut microbiome we are examining the microbial community composition and functionality changes in the gut of tobacco hornworms when exposed to CBD. Generally, our results show that despite being transient, the gut microbiome may impact the health of the insect.

Electrospun Fibers Produced from Cellulose Extracted from Hemp Biomass

Authors: Megan Dickinson

Faculty Mentors: Dr Richard Farrer

Associations: Chemistry

Abstract:

The work presented is in response to the increased interest in hemp and in the use of biomass remaining after the cultivation and processing of cannabis for oils and/or THC. In 2018, hemp became a legal agricultural commodity through the enactment of that year's Farm Bill. Hemp is a species of cannabis that contains less that 0.3% THC. The legalization of hemp has seen a rise in all things associated with it including the cannabinoids that can be extracted from the plants. The purpose of this work is to determine processes and methods that allow hemp plant material or biomass (material remaining after the extraction of oils and/or cannabinoids) to be used in the creation of electrospun fibers. Specific interest is to determine if the entirety of the plant can be used to improve the fiscal outcome associated with the cultivation of cannabis (either as hemp or as cannabis grown for THC). This specific work is interested in the processes that allow for the creation of electrospun cellulose fibers from materials extracted from cannabis plants. Each step associated with one path, from plant to electrospun cellulose fibers, is relayed in the presented work.

Protein SUMOylation in the Arabidopsis Cell Nucleus

Authors: Jayden Montoya1, Antonio Serrano1, Alma Gallegos1, Mario Izaguirre-Sierra1

Faculty Mentors:

Associations: Colorado State University Pueblo, Department of Biology, 2200 Bonforte Blvd, Pueblo, CO 81001, USA. 2Northern New Mexico College, Department of Biology, 921 Paseo Del Onate Espanola NM,87532, USA.

Abstract:

Our laboratory is focused on the study of the cell nucleus using Arabidopsis thaliana as a model system. We are using molecular genetics, genomics, and biochemical approaches to understand how the machinery inside the nucleus reacts to developmental and environmental stresses. Within the nucleus there are structures that take part in the modification of different types of ribonucleoproteins (RNPs) and non-coding RNAs. One of these structures is the Cajal body (CB). From existing preliminary data CBs are affected by post-translational modifications of its protein components. My research focuses on the small ubiquitin-like modifier (SUMO) which is known to be enriched in the nucleus and CBs. SUMO is a small protein that covalently attaches itself to other proteins modifying their function. Before SUMO can attach to any target protein it must be matured by SUMO proteases known as ubiquitin-like protease (UPL1). After SUMO undergoes maturation, it can now be attached to proteins in a process known as SUMOylation. Similarly, ULPs can be involved in deSUMOylation of proteins by cutting SUMO off of target proteins (UPL2). Poly Cajal Body (PCB) is a SUMO ULP1 protease, mutation in the PCB gene that causes disruption in CB structure due to the lack of SUMO maturation. Another focus our lab is interested in is identifying the target proteins that are SUMOylated and their role in the formation of CBs. The candidate proteins are coilin and the survival of motor neuron (SMN) as they are the key components of this nuclear body or newly renown biomolecular condensate. It is known that the absence of coilin causes the complete disruption of CBs in plants and animals. Additionally, in humans, mice, and drosophila, it has been shown that mutations in the SMN gene disrupt CB structure, similarly to mutations in the Arabidopsis PCB gene. I will use western blots, bioinformatics, and in vivo fluorescent microscopy to characterize the role of SUMO, coilin, and SMN in the formation and maintenance of the CB in plants. Altogether, our research will further the understanding of the basic biology of SUMO and its role in the cell nucleus.

The Annotation of the Bacteriophage Jazzy4900 Genome

Authors: Araceli Otero, Athena Lopez, Sean Farley

Faculty Mentors Dr. Amaya Garcia-Costas

Associations: Biology

Abstract:

Bacteriophages are viruses that infect bacteria. Phages have the capability to fight multi-drug-resistant bacteria effectively. The bacteriophages hijack bacterial cells when the phage injects its DNA or RNA into the host cell. In Dr.Amaya Garcia Costas' lab, the primary study focuses on phages that undergo the lytic cycle. Within the host bacterial cell, phages duplicate until the cell ruptures. The newly produced and released phages have the possibility to contaminate other bacteria. Bacteriophages can be found in soil; and as such previous students have found bacteriophages in many different local soils. The genome of phages is vastly unknown. The goal of annotations is to validate the presence of specific genes. The genome that is currently being annotated is Jazzy4900, a phage that was discovered by Shannon Isenhart in Lyons, Colorado. Jazzy4900 has a genome of approximately 92 genes, some of which have known functions. Two genes that distinguished themselves code for Terminase and Peptidase. The primary function of Terminase is to initiate the packing of DNA into the virus shell utilizing ATP. Peptidase facilitates the breakdown of the cell wall peptidoglycan allowing the mature page to be released. The analysis of gene function allows researchers to understand phage genomes for future medical use.

Does the Condition of Migratory Birds Increase while at Stopover Sites?

Authors: 1,2Vanessa Galvan, 1,2Viridinia Martinez, 1,2Claire Ramos

Faculty Mentors: Dr. Claire Ramos

Associations: Department of Biology, Colorado State University Pueblo; MAPS Grant, CSU Pueblo, Pueblo, CO.

Abstract:

Birds make the most dangerous journey of their annual life cycle every year, migrating during fall and spring. While the migrants travel, they need areas to replenish their energy storage to continue their journey. In areas with large bodies of water, like the Gulf of Mexico and the Great Lakes, there has been extensive research on how migratory birds gain as much fat as possible to have the energy required to fly across. However, few have examined the conditions of migrants who don't face big obstacles like big bodies of water. We investigated the body conditions of migratory species during spring migration in Fountain, Colorado, an area where migrants face few barriers to continuing their migration. We expected birds spending multiple days at our site to increase their body condition between the first and second captures. Individuals were captured via mist net, and body measurements were collected. Using paired T-tests, we compared recaptured individuals within the same season to determine fat deposits, muscle, and mass changes. We found that the body condition of the birds did not increase during their stopovers. This result may be because it was not necessary for the birds to improve their condition. After all, they faced no obstacles that required them to store energy reserves. Alternatively, our site may not provide resources that allow birds to increase conditions. This research is important for understanding the challenges birds face while migrating.

Investigation of Select Enzymes from Penicillium spinulosum Cultures Grown in Standard Growth Media with Crushed Hemp Seed as a Carbon Source.

Authors: Helena Domingues

Faculty Mentors: Rick Farrer and Jim Carsella

Associations: Chemistry

Abstract:

The objective of this investigation was to determine the effect of crushed hemp seed on the enzyme profile of the fungus Penicillium spinulosum. Fungi produces glycohydrolases and glycosaminoglycans that are a means for the fungi to attach to and attack the hemp seed. This is important to the hemp industry as fungal growth on hemp is a serious problem. As the market for hemp products increases and more products are produced for human consumption fungal contamination problems will only increase. To address this concern and build an enzyme profile on the hemp seed 10-day liquid shake cultures were made containing varying amounts of glucose and hemp seed as carbon sources. The control media consisted of the normal standard growth media (SG) with the normal amount of glucose. The subsequent cultures had reduced glucose with the difference in mass made up of crushed hemp seed. The culture contents were as follows: Control (100% glucose) 80:20 (80% glucose:20% hemp seed), 60:40 (60% glucose:40% hemp seed), 40:60 (40% glucose:60% hemp seed) and Full Test (100% hemp seed). Glycohydrolase, chitinase, cellulase, and phosphatase activity were monitored daily starting at day 1 and continuing to day 10. The results show the anticipated rise in cellulase in the initial days in the cultures containing the larger amounts of hemp seed. There was a substantial increase in chitinase activity on day 3. This increase in chitinase activity was unexpected as well as the lower activity of glycohydrolase activity. The evidence of this type of activity may suggest that hemp seeds might possess a compound that activates chitinases and hence may have anti-fungal properties since hemp does not contain chitin, but fungi possess a chitinous exoskeleton. This anti-fungal component will be the topic of future investigations.

CSU Pueblo Lower Limb Robotic Exoskeleton — Current Developments

Authors: Simon Blanco, Samuel Alamos, Pedro Arrieta, Juan Flores, and Tim Penn

Faculty Mentors: Dr. Nebojsa Jaksic and Dr. Trung Duong

Associations: School of Engineering, Colorado State University Pueblo

Abstract:

Exoskeleton technology creates many mobility options in augmentation and rehabilitation for people who have been injured, for the elderly, and people who are disabled. Previous research has focused on creating exosuits that enhances the user's ability to walk. However, enhancing the user's ability to stand up and sit down is overlooked in other exoskeleton designs. Our goal is to design an exoskeleton that reaches the required torque for the sit-to-stand motion. For our exoskeleton, we designed an actuator with a geared belt pulley system. For one leg, two identical copies of the actuator are produced (one for the hip joint and one for the knee joint) with an aluminum bar connecting to both (meaning a full exosuit has four identical copies of the actuator). The actuators are manufactured from Aluminum 6061 using a HAAS Desktop Mill CNC machine. Each actuator utilizes two optical encoders with 2000 lines that are connected to one controller. A Jetson Nano is used to test and run the actuators. With our design, we calculated a peak torque output of 170 Nm at 100% motor torque, above the 120 Nm of torque exerted by a 100 kg person as they stand up. The motor torque can be adjusted to lower the peak torque output, which is required for rehabilitation; as the user regains strength, they will need to rely on the actuator less. The thigh-knee part of one exoskeleton leg is currently constructed. Designing an adjustable belt that can be fitted to multiple body archetypes is the current focus of the research. Future work will focus on designing a system for the knee-ankle portion.

Exploring Emission Shifts in Copper-Based A-Cu-Cl (A-Cs+ or Rb+): A Structural and Luminescent Study

Authors: Anthony Bencomo Diaz

Faculty Mentors: Maxwell Wallace (Dr. Wallace)

Associations: Chemistry

Abstract:

Copper doping, specifically with Cu2+ cations, has been shown to enhance the quantum yield of A2BB'X6 perovskites through possible energy transfer from B'3+ to Cu2+. This study focuses on copper-based double perovskite A-Cu-Cl (A - Cs+ or Rb+) analogs. The structural and luminescent properties of these materials were analyzed using powder X-ray diffraction (PXRD), scanning electron microscopy (SEM-EDS), and photoluminescence measurements. Certain samples exhibit a notable shift in photoluminescence from an initial purple to a bright orange emission upon exposure to the atmosphere. This shift suggests potential applications as moisture or gas exposure sensors. Ongoing research is also examining the low-temperature structural and luminescent properties, which could also have significant implications for luminescent thermometers.

Analyzing the FH Cluster

Authors: Danny Brown1 , Dr.Amaya GarciaCostas2

Faculty Mentors: Dr.Amaya GarciaCostas

Associations: CSU Pueblo Biology, MAPS,

Abstract:

Bacteriophages, viruses that use bacteria as hosts, are increasingly recognized for their roles in microbial ecosystems and potential applications. The Actinobacteriophage database serves as a vital resource for characterizing and classifying these diverse phages. This report provides an analysis of cluster FH, a group of Actinobacteriophages identified within this database. As of February 2025, cluster FH comprises eight phages isolated from environmental samples across North America and Canada, using Arthrobacter globiformis strains as hosts. Electron microscopy reveals these phages have siphoviral morphology, while plaque assays demonstrate small- to medium-sized plaques. Genomic analysis demonstrates an average genome length of 49,552 bp with a GC content of approximately 69.8%, and circularly permuted ends. The genomes encode 76 to 81 genes, representing 132 unique gene phamilies (phams), with 50 phams fully conserved across the cluster. These conserved phams suggest functions related to structure/assembly (e.g., terminase, capsid proteins, tail proteins) and replication/recombination (e.g., helicase loader, resolvase). Notably, a subset of phams displays limited conservation, including rarer genes such as a T4-like lysozyme domain. The precise infection type remains undetermined. Gene organization within the FH cluster follows a pattern of structural genes in the 5' region and replication/recombination genes in the 3' region, with most genes transcribed in the forward direction. This report contributes to the growing body of knowledge on Actinobacteriophages, highlighting the genomic and morphological characteristics of cluster FH and providing a foundation for future functional studies.

A Methodology for Implementing the Digital Twins Technology in a Manufacturing Environment

Authors: Dominic Ayala, Gabriel Ayala, Cristopher Flores, Sherman Mcdermott, Omar Montiel, Kay Pankoski, Laura Patterson, Erika Skoglund

Faculty Mentors: Dr. Leonardo Bedoya-Valencia

Associations: School of Engineering, Colorado State University Pueblo

Abstract:

This research presents a methodology for implementing the digital twin technology for the manufacturing process of a simple product intended to provide students with an interactive experience in the machine shop. Digital twins can be used in various engineering disciplines and for personalized learning significantly enhancing the effectiveness of engineering education. Changes in skill needs are increasingly required due to the ongoing digitalization of the manufacturing industry, as well as the increasing adoption of new technologies. However, challenges such as model accuracy and data transfer must be considered when implementing them. Overall, this technology can improve student learning outcomes and increase education accessibility and cost-effectiveness. This paper discusses the requirements of the implementation of digital twins in a particular manufacturing process involving several machining operations.

Improving the Efficiency of Operating Rooms in a Local Hospital with an Artificial Intelligence, Optimization, and Simulation Approach

Authors: Dominic Ayala, Gabriel Ayala, Cristopher Flores, Sherman Mcdermott, Omar Montiel, Kay Pankoski, Laura Patterson, Erika Skoglund

Faculty Mentors Dr. Leonardo Bedoya-Valencia

Associations: CSU Pueblo School of Engineering

Abstract:

The operating room is a major cost and revenue center for most hospitals. Thus, more effective operating room management and scheduling can provide significant benefits. Several variants of the Operating Room Scheduling Problem (ORSP) can be found in a hospital setup. In a local hospital, an open scheduling policy is considered to weekly schedule elective surgeries. In the selection of surgeries, the variation of surgery duration is not taken into account. The average of the operations durations is considered for planning and scheduling. This situation can lead to either an overtime which is unwelcome by surgeons and surgical team or an underutilization of Operating Rooms (OR) resources which generate an additional cost for hospital. As patients are asked to come to the hospital in the morning, the best scheduling is the one that minimizes the patients waiting time. In order to deal with this problem, we propose an artificial intelligence-optimization-simulation approach that takes into consideration the stochastic aspect of the surgery duration. In our approach, first we will use artificial intelligence to forecast the duration of the procedures, with these values we will define an linear model to create an optimal weekly schedule for the ORs and then we will use a simulation model considering stochastic times to evaluate the robustness of the optimal schedule.

Using Clay Modeling to Teach Anatomical Structures of Birds

Authors: Kelsey Crona

Faculty Mentors: Dr.Annette Gabaldon

Associations: CSU Pueblo Biology, MAPS

Abstract:

Learning the anatomy of humans and animals requires teaching in a visual format. Many classes utilize pre-made models for observation, or pre-drawn diagrams for students to color in. While these methods can be useful for visual and auditory learners, a learning gap is created for kinesthetic students who retain information more efficiently through hands-on experience. Clay modeling is a useful tool to engage learners of auditory, visual, and kinesthetic types by creating anatomical models through an interactive process. This method, when combined with lectures and other visual aids, provides a well-rounded learning experience of complex subjects such as anatomy. Here, we demonstrate the use of clay modeling as a supplemental tool for ornithology students to deepen the understanding of avian anatomy. Model building begins with knowledge and diagrams provided through lecture which link form and function. Using diagrams as a guide, students build their models. In our examples, we feature wing structures encompassing three separate anatomical systems: skeletal, muscular, and integumentary. Construction of these models highlight how these systems work together in flight through skeletal composition, muscle attachment, and feather shape. An additional aspect of building clay models is the creation of Claymation video, which can enhance the understanding of how systems work together, such as visualizing movement of bones, contraction of muscles, and position change of feathers through flight. In whole, completed models illustrate the value of using clay modeling to not memorize anatomical structures, but remember them, and to connect the functions of one system to another. Clay modeling can be broadly applied to enhance scientific education, aiding students to develop a deeper understanding beyond memorization.

Growth and Genetic Analysis of Cajal Body Structure in Arabidopsis thaliana

Authors: Jewelianah Bell

Faculty Mentors: Dr. Mario Izaguirre

Associations: Biology

Abstract:
Inside of the cell nucleus, its composition consists of small and distinct non-membranous structures and sub compartments know as nuclear bodies. In 1903, Spanish Scientist Santiago Ramon y Cajal observed 'nucleolar accessory bodies' with a high affinity for silver staining. Named 'Cajal Bodies' (CB), they remain mysterious in their full functional capabilities, but are known for their association with metabolism and formation of small nuclear ribonucleoproteins (snRNP). These structures can be found and identified in the cells of some plants, insects, and vertebrates. The chosen plant of study, Arabidopsis thaliana, is advantageous in research of Cajal Bodies. This plant has a full genome sequence and relatively short life cycle, meaning a full generation can be cycled, crossed and propagated in a quick timeline. Not only that but this plant has around the same number of genes as humans, can be crossed and mutated, and its basic biology is similar to that of animals. Knowing this, I will be studying the presence and behavior of CB's in the genetic cross tcab 1-2 x coilin YPF within Arabidopsis thaliana. Understanding the functions and structures of Cajal Bodies could be helpful in potential treatments of the protein deficient, inherited neuromuscular disease, spinal muscular atrophy, which has been found to have a CB component.

Varied Soil Composition and the Effect on Hemp Development

Authors: Andrew Kottwitz, Ashley Archuleta, Brandon Blanchard, Colin Carter

Faculty Mentors: Dr. Jeff Smith (CSU-P), Carly Bader (Willow Industries)

Associations: Chemistry Department, Colorado State University Pueblo

Abstract:

Due to its recent decriminalization in the United States, Cannabis sativa L. is gaining popularity for its medicinal and industrial uses. This increase in popularity has served to fuel research interest in the many factors that influence the development of the plant, total crop yields, and secondary metabolite production. One of these key factors is the composition of the substrate in which the plant develops. This study examined what effect various substrate types with varying water retention and microbial content have on plant development, final yield, and cannabinoid content. To investigate, four identical grow tents were set up to prevent microbial cross-contamination. Three commercially available soil substrates were tested, along with a sterilized mixture of the three as a control. The original microbial content of each soil was analyzed before planting. Weekly measurements of plant height, leaf count, and node development were recorded, along with general observations of plant health. Initial morphological and biomass data indicates significant differences in productivity by substrate type. Final analysis of the microbial and cannabinoid data is currently ongoing.

Development and Production of Hemp Tofu through the Optimization of Processing Factors

Authors: Jalen V. Gordon1, Chad A. Kinney2,3, and Eun-Soo Kim3

Faculty Mentors:

Associations:

Cannabis Biology and Chemistry, Colorado State University of Pueblo, CO, USA1

Department of Chemistry, Colorado State University of Pueblo, CO, USA2

Institute of Cannabis Research, Colorado State University Pueblo, CO, USA3

Abstract:

Since hemp seeds have more nutrients than soybeans, hemp tofu would be a useful food material for people such as children, patients as well as vegetarians. This study explores the production of tofu from shelled hemp seeds, focusing on optimizing its texture, flavor, and color through controlled experimentation. The objective of this study is to make green hemp tofu that eliminates the greasy taste and provides more nutrients by adding various ingredients. Key variables that may influence texture include particle size of blended materials, coagulant type and ratio, compression weight and duration, and storage conditions. Flavor enhancements are investigated through salt content and selected additives, while color differentiation utilizes natural colorants such as juiced, raw green chili, raw beet root, and yellow squash, which can be used to distinguish hemp tofu from conventional soy tofu. These factors have a dramatic impact on texture and taste. The final products will undergo nutritional analysis for market viability assessment. We expect this study to positively contribute to the expanding field of developing sustainable plant-based protein alternatives.

Effect of Progressive Oxidative Aging on Asphalt Film Thickness: A Nanoindentation-Based Study

Authors: Victor Horta1, Philip Sonntag1, Christopher Beascochea1, Dr. Hasan Faisal1, Jacob Kuhn1, Mohammad Majid1, and Dr. Rafiqul Tarefder2

Faculty Mentors: Dr. Hasan Faisal

Associations: 1School of Engineering, Colorado State University Pueblo, Colorado

2Department of Civil Engineering, University of New Mexico, Albuquerque, New Mexico

Abstract:

Asphalt, a key road construction material, progressively deteriorates over time and requires continual improvements to ensure long-term durability. This study investigates how asphalt's composition and structure are affected by oxidative aging, a process where oxygen reacts with the binder, leading to brittleness and reduced flexibility. The thin asphalt film that coats aggregates in Hot Mix Asphalt (HMA) is particularly vulnerable to these changes. Film thickness was evaluated using a nanoindenter, which penetrates the softer binder layer until reaching the stiffer aggregate substrate, creating a distinct transition in the load–displacement curve. A single HMA sample was subjected to oven aging at 85 °C following AASHTO R30 guidelines, where each day of aging is equivalent to one year of field service. The unaged mixture exhibited an average asphalt film thickness of 13.23 µm, which decreased to 4.16 µm after 2 years of simulated field aging. By 4 years, the film was reduced to 1.9 µm, and after 5 years, measurements indicated a thickness of approximately 2.01 µm. These results demonstrate a significant reduction in binder film thickness during the first few years of oxidation, emphasizing the need for strategies to slow early binder hardening. Mitigating this rapid loss can help extend pavement service life by preserving a thicker, more resilient asphalt film over the aggregates.

(RD) Assessing the Role of Arbuscular Mycorrhizal Fungi (Rhizophagus aggregatus) in Enhancing Heavy Metal Uptake in Industrial Hemp (Cannabis sativa L. Verda Bio 4.21) for Phytoremediation: A Multi-Phase Study with Zinc as a Model Contaminant

Authors: Stanley Eaton, McKenna Flanigan

Faculty Mentors:

Associations: Cannabis Biology

Abstract:

Soil contamination by heavy metals is a persistent environmental challenge, posing risks to both ecological systems and human health. Industrial activities, mining, and agricultural runoff have contributed to widespread soil contamination, necessitating effective remediation strategies (Garbisu & Alkorta, 2001; Marschner, 2011). Traditional soil remediation methods, such as excavation and chemical washing, are often costly, disruptive, and environmentally unsustainable. As an alternative, phytoremediation, the use of plants to extract, stabilize, or degrade pollutants, has emerged as a promising low-cost, in-situ approach for mitigating heavy metal contamination (Ali et al., 2013; Salt et al., 1998). Among phytoremediation candidates, hemp (Cannabis sativa L.) has gained attention due to its rapid growth rate, deep root system, and ability to tolerate and accumulate heavy metals (Ahmad et al., 2016; Ivanova et al., 2003).

Prior research has demonstrated that hemp can successfully extract metals such as cadmium, lead, and zinc from contaminated soils, making it an ideal model for phytoremediation studies (Amaducci et al., 2004). However, metal uptake efficiency is influenced by multiple factors, including soil conditions, metal bioavailability, and microbial interactions (Chen et al., 2020). One such microbial factor is arbuscular mycorrhizal fungi (AMF), a group of symbiotic soil fungi that enhance plant nutrient uptake and stress tolerance. Rhizophagus aggregatus, an AMF species, has been identified as a potential enhancer of phytoremediation by increasing heavy metal accumulation in plant tissues (Seemakram et al., 2022; Aguirre et al., 2004). By forming mutualistic associations with plant roots, AMF facilitates metal absorption and translocation while reducing metal-induced toxicity (Chen et al., 2020). However, despite growing interest in AMF-assisted phytoremediation, its efficacy in hemp has not been thoroughly explored.

The Dirty Work of Weed Workers: Stigma and Shame in the Legal Cannabis Industry

Authors: Marlee Bos, Kalina Bradley, Hannah Grant, Lauren Olivares, Ryn Pantoya, Molly Rogers, Shaylan Wilson

Faculty Mentor: Dr. Aaron Samuel Johnson

Associations: Discovery Scholars

Abstract:

Despite the legalization and rapid growth of the legal cannabis industry, many weed workers continue to face stigma, judgment, and social exclusion due to their profession. This ethnographic study, conducted as part of the Southern Colorado Cannabis Industry Ethnography (SCCIE), examines how cannabis industry employees perceive, experience, and manage stigma in both their professional and personal lives.

Through inductive, thematic analysis, three key themes emerged: (1) Participants reported concerns about misunderstanding and judgment from family, friends, and mainstream professional networks, highlighting persistent stigma even in legal markets. (2) Many workers conceal and/or selectively disclose their employment to avoid confrontation, discrimination, or reputational harm. (3) Despite state-level legalization, cannabis work remains culturally linked to illicit activity, leading employees to struggle with professional legitimacy and societal acceptance.

These findings suggest that legalization alone is insufficient in eliminating the deeply ingrained stigma surrounding cannabis. Instead, weed workers actively engage in identity work and stigma management techniques such as selective disclosure, reframing their work as legitimate business, or emphasizing the medical and wellness aspects of the industry. We argue that while cannabis industry employment provides economic opportunity and high job satisfaction, it remains burdened by historical stigmatization, and that the persistence of stigma has significant implications for workforce development, mental well-being, and policy advocacy. This study underscores the need for public education, policy reforms, and normalization efforts to reduce the social costs borne by workers in this emerging industry.
We conclude with recommendations for policy interventions, public education, and workplace advocacy, ensuring that legal cannabis workers are afforded the same social and professional legitimacy as their counterparts in other industries.

College of Humanities, Arts, and Social Sciences

& Hasan School of Business

Music Composition: The Baroque Suite and Its Parts

Authors: Gabriel Saldaña

Faculty Mentor: Dr. David Volk

Associations: Music

Abstract:

The Baroque suite is one of the earliest multi-movement forms in music. Though this form fell from common practice after the death of Johann Sebastian Bach in 1750 (and even earlier, as Bach was seen as a more conservative composer for his time), the suites are still performed today. A suite is a collection of dances, usually short ones. In its early years, the suite was used as background music for patrons to dance to. Later in the Baroque period, and certainly in J.S. Bach's lifetime, the suite began to be treated like the Classic Sonata; a way to showcase the technique and talent of a performer. The dances in the suites are usually all in the same key—the key of the suite—and mostly all in binary form. Understanding the structure of these dances is a great way to showcase form to an early composition student, as they don't have to be very long pieces.

Qualitative Analysis of Paranormal Experiences

Authors: Charlotte Kneuper

Faculty Mentor: Dr. Richard Walker

Associations: Psychology

Abstract:

Despite lacking physical evidence, paranormal beliefs are widespread. This study examines the qualitative characteristics of personally experienced paranormal event descriptions. A total of 109 participants (59 from M-Turk, 50 from CSU) completed surveys detailing their experiences, categorized into Ghosts/Hauntings (43%), UFOs/Aliens (22%), Creatures (7%), Feelings (16%), and Mixed (11%). Text analysis using LIWC revealed that Ghost and UFO descriptions were lengthier, while UFO reports contained fewer emotional words. UFO/Alien events also showed lower physicality but higher visual perception. Surprisingly, tentative language correlated positively with certitude, indicating participants expressed more confidence when they were less certain.

SXSW 2025: Exploring Innovation and the Future

Authors: Jess Byrd, Nick Cassias, Tanner Clark, Ashlyn Drury, Emma Harry, Ray Joens, Dave Moody, Cidonia Ponce, Quinna Rollings, Alorah Saldana-Vigil, Holly Ward

Faculty Mentor: Dr. Jon Pluskota

Associations: Media and Entertainment

Abstract:

The future of innovation and technology across industries is presented from first-hand experiences of 11 students who embarked on an immersive course at South by Southwest (SXSW) in Austin, TX. Known originally for its music festival, SXSW has expanded over its four decades of existence to bring the latest technology, innovation, trends and topics from a variety of industries. From sports, women's health, education, and med tech to the film, music, art, social media and journalism industries, students learned first-hand how advances in technologies are changing how we live, work, and play. This interactive poster presentation features experiences and explorations from participants, each of whom attended a minimum of 20 sessions over 8 days. Through their documented experiences, the audience will learn what the future has in store across different industries and technologies.

Behind the Scenes of a Composer

Authors: Hannah Sin-Purnell

Faculty Mentor: David Volk

Associations: Music

Abstract:

Being at Colorado State University Pueblo has allowed its students to compose works and record performances while getting the experience and knowledge to become fully self-published composers. But what does a composer actually do behind the scenes and what is the entire process to achieve all of this? For all composers and songwriters, the process and experiences may be different and unique, but a look behind the scenes can help give a glimpse of what a composer does for a living. This presentation will be a brief introduction and a glimpse into my personal experiences and process, showcasing a summary of my time and experiences as a student composer. From writing music manually or on notation software, the process of handmaking scores and printing parts, the first rehearsals and reading sessions, and registering for PROs and publishing work online on a website.

How Cannabis Users and Non-Users View the Benefits of THC

Authors: Paz Mendez

Faculty Mentor:

Associations: Psychology

Abstract:

Users of THC cannabis have many reasons for why they use the substance. These include sleep aid, help focusing, using it for fun, as a substitute for other illicit drugs, and relief from underlying mental or physical conditions. With this knowledge, another question was determined, focused on determining possible differences in the agreement of users or non-users of THC cannabis regarding these possible benefits of the substance. Three main categories of benefits were determined, and a survey was given to 20 participants, talking about certain benefits and how much they agree or coincide with the statements in the survey. Results showed that non-users and users of THC cannabis differed significantly in their viewpoints of THC's benefits in the sleep and focus category. The other two categories of benefits were substitution/fun and physical/mental relief. These showed no significant difference in the beliefs of benefits between users and non-users of THC cannabis.

Roman Republic and the Nobility: Political Gain, Bribery and Manipulation

Authors: Arianna Barela

Faculty Mentor: Judy E. Gaughan

Associations: History

Abstract:

Despite claims that the Roman Republic practiced separations of power between the senate, consuls, and people, there was also a recognizable hierarchical system that consistently allowed the nobility to overthrow, dominate, and manipulate society to their favor. Noblemen in the Republic guided society with their ideals in mind, and there was not much anyone of lower rank did or could do to change the fact. However, towards the end of the Republic, there seemed to be a shift in control; some blamed the act of electoral corruption in the form of bribery or *ambitus.* Bribery itself can only be blamed for the reasoning or justification behind this political shift. The reason itself was the creation of laws based on electoral corruption. This shift diminished the nobility's power as the Republic progressed and in tune made a whirlwind for new types of corruption. Therefore, the only flaw with bribery was the enhanced authority and standard it created for the people. Further proving that the aristocracy in Rome's need for stronger reputations and political prowess was at the base of these laws the same way bribery was, proving that bribery was not the direct cause.

Beyond Belief, A Study on Autobiographical Memories of the Paranormal

Authors: Charlotte Kneuper, Sofia Marquina, Isabella Gaughan

Faculty Mentor: Dr. Richard Walker

Associations: Psychology

Abstract:

Memory plays a crucial role in shaping our understanding of personal experiences, it is also imperfect and subject to change. This study explores the characteristics of paranormal memories compared to everyday autobiographical memories, examining their consistency with established cognitive processes.

A model for information security vulnerability awareness

Authors: Roberto Mejias, Joshua Greer, Gabrila Greer, Morgan Shepherd, Raul Reyes

Faculty Mentor: Roberto Mejias

Associations: CIS-Colorado State University Pueblo, University of Colorado, University of Arizona

Abstract:

As new and evolving technologies are rapidly adopted by organizations, often without the integration of cyber security safeguards, information systems have become increasingly vulnerable to a range of cyber threats. Our research suggests a multi criteria approach in analyzing possible factors that influence an awareness of information security vulnerabilities. Drawing from prior cyber security and vulnerability assessment research, this empirical field study develops a research model to analyze possible determinants influencing information security vulnerability awareness. Three constructs were considered to explore their association to information security vulnerability awareness: vulnerability assessment, assessment of IS security controls, and knowledge of an organization's cyber threatscape. The data analyzed was obtained via a survey questionnaire instrument. Confirmatory factor analysis and structural equation modeling were used to validate the proposed research model. Results of this analysis indicate that these three constructs and the related indicator constructs are significantly correlated with an awareness of information security vulnerability. These results provide useful insights for organizations regarding their awareness of information security vulnerability and an increasingly evolving global cyber threatscape.

Abstract Roman Feminisms: Pudicitia and Female Sexual Morality in the Roman Republic

Authors: Olivia Winkelman

Faculty Mentor : Dr. Judy Gaughan

Associations: History

Abstract:

There is a Roman moral quality called *pudicitia* that is loosely defined as the sexual virtue of a married woman who was sexually intact upon marriage. *Pudicitia* served both as protection and damnation for Roman women. I will be making this argument by examining two versions of the myth of Lucretia, Livy's and Dionysius of Halicarnassus', the narrative origins of *pudicitia,* and through exploring gendered Roman ethics. I will seek to define *pudicitia*, place it in Roman society, and establish the social rules surrounding it.

Text to Connect: A Modern Approach to Graduate Student Support

Authors: Megan Mitchell

Faculty Mentor:

Associations: Social Work

Abstract:

In January 2024, I spoke with some CSU Pueblo students about the need for accessible, short-term support that can easily be integrated into our busy schedules. Inspired by this concept, I created the Text to Connect program. As a Master of Social Work student, I am interested in understanding the systems that promote (or inhibit) behaviors that effectively contribute to academic success and student retention. I feel confident that the Text to Connect program will address the overwhelming stress and anxiety of our CSU Pueblo student population by providing a structured support program that is both safe and responsive to the unique obstacles that today's students face. I have had the privilege of collaborating with student organizations, university partners, and community partners, including Spark the Change Colorado, NAMI, Campus Connections, and CHASS. When students engage with our service, they will be connected to a graduate peer success coach (GPSC) who is a current MSW student at CSU Pueblo. The GPSC will work with the student individually to provide one-on-one support and identify the next steps to ensure future success. At the end of the conversation, the GPSC will give the student the option to receive up to three follow-up messages regarding the concern they presented. If the student needs additional support, the GPSC will assist the student in identifying people, groups, or services that can help meet the student's needs long-term. The Text to Connect program uses internal procedures and external resources to provide multiple levels of intervention to students in need. I look forward to seeing how this program will help students and will continue to advocate for the prioritization of mental health in academic settings.

Student Overinvolvement is Correlated with Lower Levels of Academic Engagement

Authors: Emily Berry

Faculty Mentor: Dr. Richard Walker

Associations: Psychology/Social Work

Abstract:

Colleges want students to be involved in campus activities and to be engaged with campus culture. These concepts, while sharing overlap, have important differences. Student involvement refers primarily to the behaviors outside of class, such as participation in clubs or honor societies. Student engagement is a psychological investment with cognitive and emotional components. While low or moderate levels of involvement may boost engagement, overinvolvement may harm engagement. Data was collected from participants at a public university and at a private university with a religious affiliation (N=113). Students completed the Overinvolvement Scale (OIS) and the Higher Education Student Engagement Scale (HESES). Results showed internal validity for both the OIS and HESES. Feelings of overinvolvement were correlated with lower levels of academic engagement. Unexpected sample differences suggest that students at private religious universities seem to express higher engagement levels.

Exploring County-Level Patterns of Police-Involved Homicides in the U.S.: A Geographically Weighted Regression Approach

Authors: Alex Hasui

Faculty Mentors:

Associations:

Abstract:

This study contributes to research on neighborhood effects and police-involved homicides by examining how violence levels, racial and ethnic composition, and socioeconomic disadvantage shape county-level patterns of fatal police encounters in the United States. Drawing on the ecological theory of crime and policing, it further investigates whether these relationships vary spatially. Using Geographically Weighted Poisson Regression (GWPR), findings reveal significant spatial heterogeneity in the impact of key community factors. These results underscore the importance of local context in understanding and addressing police violence across diverse urban landscapes.

PATTERNS OF PROTEST: Why Did Black Lives Matter (BLM) Protest Spread to Some Cities and Not Others?

Authors: Tiffani Wilbur, Hunter Hayslett

Faculty Mentors:

Associations: Discovery Scholars, Colorado State University Pueblo

Abstract:

Previous research on the first wave of BLM protests (2014-2016), found that cities where there were recently publicized cases of fatal police brutality were more likely to experience protests, compared with cities without such cases (after controlling for population size, and other factors; Williamson, Trump, and Einstein 2018). This is consistent with a grievance-based explanation for social movement mobilization (e.g. Useem 1985). However, in 2020, in response to George Floyd's murder by Minneapolis police, BLM protests erupted in cities throughout the US (and even internationally), including many without any recent local cases of fatal police brutality. These protests even erupted in many small communities in which protests on any issue had been exceedingly rare if not unheard of, leading some scholars to conclude that it may be the largest (Buchanan, Bui, and Patel 2020) and broadest (Putnam, Chenoweth and Pressman 2020) movement in U.S. history. This leads us to question what other factors, besides local cases of fatal police brutality, might explain why some cities participate in BLM protests while others do not. One possibility is that the protests are more likely to occur in cities with a greater perceived chance of achieving local police reform, which is what social movement scholars call political opportunities (Meyer 2004). A key factor of the local political opportunity structure is who occupies the seat of the mayor, city manager, or other top local executive positions (Hoang and Benjamin 2023). For this presentation, we investigate whether the race, gender, or political party of the sitting mayor helps explain why BLM protests occur in some cities and not others, after controlling for other factors at the city level that may also play a role, such as population size, political climate, racial makeup, and poverty rate.

MY HELP IS STRONG: A Helping Device for The Elderly and Disabled Persons

Authors: Georgetta Liddile-Kruger

Faculty Mentors:

Associations: Sociology

Abstract:

My Help is Strong, is a helping device that would assist the Elderly and the disabled person with carrying hot items, heavy items and cold items safely to their dining table, workshop table or learning table (area). This device is an “add on” extension piece that is designed to help the user who may have shaky hands, unstable balance in their walk and for people who may be isolated and living alone with no one to assist them with these tasks.

ChatGPT and Intercoder Reliability: An Analysis of Colorado Newspaper Framing of Renewable Energy

Authors: Risa Luzardo, Alex Moe, Desyree Rhode, Michael D. Briscoe

Faculty Mentors: Michael D. Briscoe

Associations: Sociology

Abstract:

Intercoder reliability is a measure used in qualitative research to ensure that codes have been applied appropriately. It is used to reduce subjectivity in coding and boost empirical support for qualitative findings. One emerging tool that can be used for measures of intercoder reliability are large language models (LLM), the most popular of which is ChatGPT. In this study we analyzed articles from four Colorado newspapers on renewable energy and code them according to several different frames using a coding scheme developed collaboratively. We then gave this coding scheme to ChatGPT, along with the articles and asked it to code the articles using the scheme. Our results show that while ChatGPT can help to show instances where coding errors occurred, it struggles with nuance that can be important while coding. As LLM models improve they can likely serve as tools to improve reliability in qualitative research, but currently underperform in this task.

College of Health and Education & School of Nursing

The effect of Mulligan mobilization with movement on acute elbow injuries in high school and collegiate athletes: a pilot study

Author: Kate Raphael

Faculty Mentor: Dr. Mary Placzkowski

Associations: Athletic Training

Abstract:

The elbow is a structurally and functionally complex joint, designed to withstand significant exertional forces and facilitate unique movement patterns. Its intricate anatomy, combined with high load and force, makes the joint susceptible to injury, particularly from repetitive and/or overhead motions. The High School Reporting Information Online (RIO) collected baseball and softball-related injury data from 2005-2015. The results revealed an overall elbow injury rate in high school baseball players to be 0.92 per 10,000 athletic-exposures (AE) and 0.43 per 10,000 AEs for softball, with 50.2% of the injuries from baseball occurring in pitching.[1] Between 2009 and 2014, the National Collegiate Athletic Association (NCAA) conducted a 5-season surveillance on elbow injuries and noted 343 elbow injuries across 11 varsity sports yielding an overall injury rate of 1.76 per 10,000 athlete-exposures (AEs) with the highest incidence rates occurring in wrestling, baseball, and tennis.[2]

Given these high injury rates, effective treatment approaches are crucial. Manual therapy techniques like Mulligan Concept Mobilization with Movement (MC MWM) show promise in managing acute non-specific elbow pain. MWM involves sustained joint mobilization combined with active or passive movement to improve function and alleviate pain. This study aimed to assess the efficacy of MC MWM, specifically, as a universal treatment option for acute and non-specific elbow pain. Results of this pilot study indicate that the MC MWM treatment significantly reduced pain within 1-4 visits, suggesting that MC MWM techniques targeting the elbow may effectively alleviate a broad range of patient-reported symptoms related to acute elbow pain.

Exploring the Impact of Physical Activity on Mental Health

Authors: Noah Calderon, Jeremiah Carter, Corban Coletti

Faculty Mentors: Dr. Christine Rochester

Associations:

Abstract:

The purpose of this study is to measure the impact of exercise on the mental health of specific exercise groups in Pueblo, Colorado. With growing awareness of the relationship between physical activity and mental well-being, our research seeks to explore how different levels and types of exercise may contribute to mental health outcomes. To achieve this, we have developed a survey designed to assess variations in mental health among five distinct groups: indoor collegiate athletes, outdoor collegiate athletes, outdoor exercisers, indoor exercisers, and non-exercisers. By comparing these groups, we aim to determine whether specific exercise environments and habits influence mental well-being differently.The survey, adapted from the Mental Health Inventory from the Medical Outcomes Study and provided by the nonprofit organization RAND, includes a series of questions designed to evaluate participants' mental health experiences over the past month. Some of these questions ask: How often did you find your daily life interesting? Did you have trouble concentrating during activities? Did you feel depressed? Has your life been full of things that have been interesting? How happy, satisfied, or pleased have you been with your personal life? Respondents will answer using a six-point Likert scale, allowing for a nuanced assessment of their mental health status.

We have now begun distributing the survey and are in the process of collecting responses from participants across the identified groups. This stage of the research is critical, as it will provide the necessary data to analyze patterns and potential relationships between exercise habits and mental health outcomes. Our goal is to gather a diverse range of responses that will allow us to draw meaningful conclusions about the role of physical activity in mental well-being. While we have not yet reached the analysis phase, our initial interactions with participants have provided valuable insight into the community's engagement with mental health and exercise. Once data collection is complete, we will analyze the results to identify trends and correlations between exercise participation and various aspects of mental health, such as mood stability, stress levels, and overall life satisfaction. We anticipate that our findings will contribute to the ongoing discussion surrounding the psychological benefits of physical activity, particularly in the context of college students and community members in Pueblo.

Kirby Bauer Analysis of UV Light Resistant Bacteria

Authors: Leathea Mitchell

Faculty Mentors: Amaya Garcia Costas,

Associations: Colorado State University-Pueblo, Department of Biology, Pueblo, Colorado, United States

Abstract:

Kirby Bauer test is very helpful in microbiology, this method of testing is used to help us determine what types of antibiotics are bacteria resistant too. I was interested in finding if UV-resistant bacteria can also be resistant to antibiotics, In order to develop sampling tools, I first had to run a trial study using E.coli. The antibiotics that were used were TE30, SXT, and E15. With this trial study I was able to determine whether E. coli is resistant to the antibiotics, with that information I can further apply it to my research of seeing how the UV Light resistant bacteria response to antibiotics.

In adult patients at high risk for cancer, does AI-driven blood biomarker analysis, compared to traditional cancer detection methods, result in earlier diagnosis?

Authors: Jordan Acosta, Michael Crook, Steven Jacobs, Tristan Jacobs, Christopher Patterson

Faculty Mentors Dr. Amaya Garcia-Costas

Associations: Biology

Abstract:

Purpose: This translational research study examines the role of artificial intelligence (AI) in improving early cancer detection. AI-driven technologies enhance screening accuracy and efficiency, which is critical for nursing practice and patient care. Background & Significance: Traditional cancer screening methods have limitations, including false positives, false negatives, and reliance on invasive procedures. AI has emerged as a promising tool for early cancer detection by analyzing medical imaging, identifying serum biomarker patterns, and using machine learning for risk assessment. By improving diagnostic accuracy and reducing late-stage diagnoses, AI supports evidence-based nursing practice and patient-centered care. Methods: This is a translational research study utilizing a literature review design. All authors hold current certifications for the Collaborative Institutional Training Initiative's (CITI) online training for "Biomedical Research: Basic Course on Research Ethics." This study does not include human subjects and is exempt from IRB approval. Conclusion: AI-driven cancer detection improves screening accuracy, particularly in breast and lung cancer. AI enhances biomarker-based screening and reduces diagnostic delays. As nurses integrate technology into patient care, understanding AI's capabilities and limitations is essential for optimizing early cancer detection.

Keywords: Artificial intelligence, early cancer detection, oncology, nursing practice

Harmonica Therapy for Chronic Obstructive Pulmonary Disease Patients-Quality Improvement

Authors: Kylee Provost

Faculty Mentors: Drs. Susan Petrin, Ryan Van Gilder, and Craig Shapiro MD

Associations: Graduate Nursing

Abstract:

Chronic Obstructive Pulmonary Disease (COPD) is a progressive lung disease with no cure, but treatments and lifestyle changes can slow its progression. Smoking cessation, staying active, and pulmonary rehabilitation are key interventions for managing COPD. Despite the effectiveness of pulmonary rehabilitation, its uptake is low among patients. Harmonica therapy, as recommended by the COPD Foundation, offers a convenient alternative that helps patients practice breathing techniques, potentially improving symptoms of COPD in the comfort of their homes.

This quality improvement (QI) project focuses on evaluating the effectiveness of harmonica therapy for adult patients with moderate to severe COPD in an outpatient pulmonary clinic setting. The study aims to assess patient-perceived improvement in symptoms of dyspnea (shortness of breath) through objective measures, including the 6-minute walk test (6MWT), Forced Expiratory Volume (FEV1) from spirometry, and the Modified Medical Research Council (MCR) dyspnea scale.

Keywords: COPD, music, harmonica, pulmonary rehabilitation, 6MWT, spirometry, MCR dyspnea scale.

Motivational Interviewing Effects on Treatment Adherence

Authors: Janae Norman, Callie Britton, Liz Pearson, Olena Ellis

Faculty Mentors:

Associations: CSU Pueblo Nursing

Abstract:

Purpose: The purpose of this translational research study is to evaluate how motivational interviewing techniques affect treatment adherence and outcomes in adult patients. Background & Significance: Motivational Interviewing (MI) is a patient-centered communication technique rooted in empathy and respect for patient autonomy, rather than confrontation or persuasion. The significance of MI in nursing care is to enhance patient-centered communication and promote self-efficacy, which can lead to more meaningful and lasting behavior changes. Methods: This is a translational research study utilizing a literature review design. All authors hold current certifications for the Collaborative Institutional Training Initiative's (CITI) online training for "Biomedical Research: Basic Course on Research Ethics". This study does not include human subjects and is exempt from IRB approval. Findings: The evidence found in the studies reviewed supports motivational interviewing over standard communication methods to foster positive patient outcomes. Conclusion: MI implemented in nursing practice can be associated with positive self-efficacy, quality of life, medication adherence, and activity levels pre- and post-discharge.

Keywords: motivational interviewing," "nursing," "adult," "treatment outcomes" and "treatment adherence."

Effects of Implementing the Critical Care Pain Observation Tool on Length of Intubation

Authors: Angela Hensley

Faculty Mentors:

Associations: Nursing

Abstract:

Prolonged intubation beyond 48 hours increases the risk of ventilator-associated infections and other adverse events. Frequent and standardized pain assessments such as the Critical Care Pain Observation Tool (CPOT) may help prevent oversedation, encourage earlier participation in spontaneous breathing trials, and reduce ventilator days by ensuring that pain is accurately assessed and managed. This Doctor of Nursing Practice (DNP) Quality Improvement (QI) project investigated whether standardizing the CPOT in adult intensive care units could reduce the duration of intubation in patients. Using the Plan-Do-Study-Act (PDSA) framework, the initiative focused on training nurses to perform consistent pain assessments at least every four hours and prior to adjusting sedation. Over the course of six weeks, 86 intubated patients who met the inclusion criteria were evaluated before and after the intervention, with 43 patients in each group. Pre-intervention data indicated a mean intubation length of 4.51 days, which decreased to 3.72 days post-intervention, representing a 17.52% reduction. Although the Mann-Whitney U test did not reveal a statistically significant difference in intubation times ($U=1053.5$, $p=0.259$), the sample size may have been insufficiently powered. A power calculation suggested that approximately 365 patients per group would be necessary to detect a modest effect size with adequate statistical power (0.80). If this approach is replicated on a larger scale with an appropriate sample size, it could further support the idea that structured, consistent pain assessments and targeted analgesia lead to improved patient outcomes.

Keywords: mechanical ventilation, CPOT, pain management, sedation, critical care, quality improvement

Addressing Adolescent Mental Health: The Impact of Education and Resources on Depression and Suicide Risk

Authors: Dayari Cartagena, Harmony Clearo, Sheri, and Lindsay Woods

Faculty Mentors:

Associations:

Abstract:

Purpose: The purpose of this translational research study is to determine if education and resources provided to high school aged adolescents help to reduce the incidence of depression and suicide risk. Background & Significance: Suicide is the second leading cause of death among young individuals aged 10-24 in the United States. High school students are a vulnerable group due to various social and psychological stressors such as academic pressures, peers and developing mental health. With increased risk of depression and anxiety due to bullying, cyber bullying etc., students also struggle to seek help due to stigma. Research has shown that prevention programs have been effective in reducing suicide attempts among students by. Methods: This is a translational research study utilizing a literature review design. All authors hold currency certifications for the Collaborative Institutional Training Initiatives (CITI) online training for “Biomedical Research: Basic Course on Research Ethics.” This study does not include human subjects and is exempt from IRB approval. Findings: This study examined suicide literacy and attitudes among adolescents, highlighting between loneliness and suicide to raise awareness of suicide risk. Conclusion: Stigma and poor mental health literacy remain significant barriers to help-seeking, reinforcing the need for better education and intervention programs. Expanding school-based resources and implementing targeted prevention strategies, such as the "Signs of Suicide" program, could be crucial steps in addressing these challenges. School-based mental health services, including wellness centers, have been shown to be effective in reducing stress and improving emotional well-being. Their success depends largely on the implementation of these programs in a school or community setting.

Keywords: Suicide literacy, Suicide attitudes, Adolescents, Stigma, Mental health literacy, Help-seeking behavior, Loneliness, Suicide risk

Enhancing Preoperative Risk Stratification for Elective Surgical Patients

Authors: Eric Joseph Pelletier

Faculty Mentors: Dr. Jacqueline Itambo, DNP, AGACNP-BC & Dr. Pamela Love, Ph.D., MSN, RN, CNE

Associations: Nursing

Abstract:

The primary objective of this project is to reduce last-minute cancellations of elective surgeries, which result in significant inconvenience to patients and operational inefficiencies. The project identifies critical gaps in preoperative protocols, largely related to inadequate patient education, communication challenges, and incomplete risk assessments. To address these issues, the project proposes the implementation of the Surgical Risk Preoperative Assessment System (SURPAS) tool—a quantitative instrument that enhances risk stratification by evaluating eight preoperative patient risk factors. Utilizing a pre-post implementation design and the Plan-Do-Study-Act cycle change model, the project compares cancellation rates derived from the EPIC electronic health record before and after the tool's integration. The project's outcomes are expected to enhance surgical scheduling and patient care, providing broader insights that can inform future policy and resource allocation decisions in perioperative settings.

Patient Education on the Risks and Benefits of Polypharmacy and the Effect on Medication Safety and Adherence

Authors: Kira Castle, Cora Conis, Shane Hayduk, Brooklyn Mack, & Krista-Leigh Prevatt

Faculty Mentors: Dr. Brown

Associations: School of Nursing

Abstract:
Purpose: The purpose of this translational research study is to determine how patient education on the risks and benefits of polypharmacy affects medication safety and adherence versus no such education. Background & Significance: Polypharmacy is a widespread issue in acute care settings, particularly among older adults, and is linked to an increase in adverse health outcomes such as falls, drug-drug interactions, cognitive impairments, prolonged hospital stays, and higher healthcare costs. Methods: This is a translational research study utilizing a literature review design. All authors hold current certifications for the Collaborative Institutional Training Initiative's (CITI) online training for "Biomedical Research: Basic Course on Research Ethics." This study does not include human subjects and is exempt from IRB approval. Findings: Patient education improves medication adherence and improves patient safety by reducing negative health outcomes. Conclusion: Through patient-centered education and collaboration, healthcare providers can help patients following polypharmacological medication regimens take their medications more safely and support better health outcomes

Keywords: polypharmacy, patient education, health outcomes, medication safety