Higher Education Research Council
Undergraduate Research Fellows
Boise State University
Final Report

Academic Year 2022-2023

Donna Llewellyn, Executive Director, Institute for Inclusive & Transformative Scholarship
Nico Diaz, Senior Student Initiatives Coordinator, Institute for Inclusive & Transformative Scholarship
Lavanya Seetamraju, Undergraduate Research Project Manager, Institute for Inclusive & Transformative Scholarship

Introduction

The Institute for Inclusive & Transformative Scholarship oversaw the HERC Undergraduate Research Fellowship at Boise State University Fall 2022, and Spring 2023. HERC funds were used to support Boise State undergraduate students who had minimal research experience with a 10-week mentored research opportunity during the fall and spring semesters. Funds provided by the Higher Education Research Council supported a total of 19 students across 13 different STEM disciplines.

On behalf of the Institute for Inclusive & Transformative Scholarship, we thank the Higher Education Research Council for their generous support in helping build meaningful experiential learning experiences for Idaho students and supporting faculty research.

The Higher Education Research Council provided $65,000 in funding to support STEM undergraduate research at Boise State University this year. Please see the table below of how stipends and travel awards were dispersed.

HERC Funding:

Stipends	**Amount**	**Details**
Fall Semester Research Stipends	$27,000	9 students at $3,000 each
Spring Semester Research Stipends	$33,000	11 students at $3,000 each
Additional Research Support Spring	$1,800	1 student at $1,800
Travel grants	$3,200	see table below
Total	**$65,000**	

Conference	**Amount**	**Details**
Intermountain Social Research Lab	$1088.89	Students travel and lodging to Seattle, WA
APS Conference for Undergraduate Women in Physics (CUWiP)	$525	2 students registration, travel, and local transportation in Seattle, WA
European Conference on Innovation and Entrepreneurship	$1,128.15	1 student airfare to Portugal
Raptor Research Foundation Conference	$457.96	1 student registration and airfare to Albuquerque, NM

The titles and abstracts of the student projects are on the following pages.

Fall 2022 and Spring 2023 HERC Fellows
Research Projects

Fall 2022 Fellows

Alejandra Almaraz, Materials Science and Engineering

Title: Atomic Force Microscopy for Aerospace Applications
Abstract: On July 20, 1969, the Apollo 11 astronauts became the first humans to set foot on the moon. Since then, science has evolved rapidly, and many more astronauts have ventured out to explore more of the vastness of outer space. Although there have been many more successful space missions since then, scientists have discovered that astronauts experience bone and muscle degeneration while in a reduced gravity environment for extended periods of time. The ability to remain in outer space longer with less tissue degeneration would enable more information gathered with less risk. To offer a solution, in collaboration with Dr. Gunes Uzer and Dr. Sean Howard, the nanomechanical properties of mesenchymal stem cell (MSC) nuclei were analyzed using atomic force microscopy (AFM). Specifically, AFM cantilever-based nanoindentation was employed to measure the stiffness (elastic modulus) of treated nuclei relative to control nuclei, indicating the results of the various treatments (low intensity vibrations (LIV), structural knockouts, and pharmaceuticals) applied to the MSCs in Dr. Uzer's lab.

Ellie Cain, Kinesiology

Title: An intervention to combat the negative effects of perfectionism by incorporating elements of self-compassion for youth gymnasts
Abstract: In general, perfectionism means to not accept any results that are not considered "flawless". Perfectionism is a topic that has been widely researched in clinical settings but more research is needed in the sports environment. The current project aims to investigate interventions aimed at reducing perfectionistic tendencies in the sport of gymnastics, a context that may be especially prone to developing perfectionism. There are two widely accepted dimensions of perfectionism: perfectionistic strivings and perfectionistic concerns. Perfectionistic strivings are having high personal standards and wanting to achieve high goals while perfectionistic concerns are worries about making mistakes and evaluating oneself based on performance/mistakes. Perfectionistic striving typically produces adaptive outcomes, while perfectionistic concerns are viewed as the maladaptive aspects of perfectionism including poor performance, anger, anxiety, depression, and other maladaptive behaviors. (Dunn et. al, 2018). It is for this reason that perfectionistic concerns are targeted in interventions. One construct that seems to be possible to contrast the negative effects of perfectionistic concerns is self-compassion. Self-compassion is when someone has an accepting, supportive, and nonjudgmental attitude directed towards themselves and can alleviate suffering while enhancing overall mental health (Mosewich). The goal of incorporating this construct is to highlight perfectionistic striving elements and diminish perfectionistic concerns. For this project, we have developed four workshops that will be introduced to youth gymnasts in order to educate them about perfectionism and combat its negative effects in both sport and other domains. To evaluate the intervention, athletes will complete the Perceived Stress Scale, Sport Multidimensional Perfectionism Scale, and Self Compassion scale before and after the intervention.

Fall 2022 and Spring 2023 HERC Fellows
Research Projects

Zachary Camargo, Chemistry/Mathematics

Title: Synthesis of a Prebiotic Iron Cyanocarbonyl Complex
Abstract: Organometallic compounds delivered by extraterrestrial meteorites may have been crucial to the development of hydrogenase enzymes on early Earth. Here, we used two different published methods to synthesize an iron cyanocarbonyl complex resembling parts of the active sites of these enzymes. This complex was characterized via infrared (IR) spectroscopy and mass spectrometry for use as a standard for future research on the topic of enzyme origins.

Catherine Isaak, Biology

Title: Phenology of the Great Horned Owl (Bubo virginianus) population in coastal Texas and its potential effects to the endangered Northern Aplomado Falcon (Falco femoralis septentrionalis)
Abstract: Phenology of the Great Horned Owl (Bubo virginianus) population in coastal Texas and its potential effects to the endangered Northern Aplomado Falcon (Falco femoralis septentrionalis) by Catherine L. Isaak, David Bontrager, and Dr. Jennyffer Cruz
Anthropogenic activities such as wildfire suppression, overgrazing, and climate change contribute to shrub encroachment of native plains and savannas. These changes may seem insignificant but can result in unintended consequences for species inhabiting savannas. The Northern Aplomado falcon was extirpated from the U.S. in the early to middle 1900s, and in 1986 the species was listed as an endangered species under the Endangered Species Act. For three decades, the Peregrine Fund has tried to reintroduce the species in west and south Texas and southern New Mexico. Shrub encroachment has changed the south Texas coastal plains and savannas to the possible disadvantage of the Northern Aplomado Falcon (Falco femoralis septentrionalis). We hypothesize that Great Horned Owls (Bubo virginianus) (GHOW) have taken advantage of these modified habitats, bringing them in closer proximity to the Aplomado Falcon population in the Laguna Atascosa National Wildlife Refuge. I conducted a literature review to establish phenology patterns for Great Horned Owls across North America. I compared results from the literature review against sound data collected in late December 2021 to early March 2022 with three autonomous recording units and processed the sound data through Raven Pro software. Specific vocal patterns indicative of a GHOW were checked manually. Breeding phenology for GHOWs starts with male advertisement via hooting, followed by an incubation period of 33 days on average and completed by eight weeks with nestlings until fledging. Overall, phenology of GHOWs in coastal Texas resembled those from the Yukon in southwestern Canada, which is surprising given the large latitudinal differences between these two locations. Late December was probably too late to start monitoring GHOWs so we suggest shifting monitoring to starting in November and ending in early March. Appropriate timing of monitoring protocols is essential to ensuring accurate estimates of owl distribution and abundance. GHOWs are likely to prey on juvenile Aplomado Falcons. After fledging, higher numbers of GHOWs juveniles may remain for six to eight months before the juveniles disperse. This represents May to November, possibly to January where there are an increased number of GHOWs in coastal Texas.

Elizabeth Jessmore, Biology

Title: DNA Fecal Extractions; The Power of Poop
Abstract: The research for this HERC fellowship consisted of my involvement in two aligned research projects in the Conservation Genetics Lab at Boise State University, one relating to Sharp-tailed Grouse (Tympanuchus phasianellus) the other to Greater Sage-Grouse (Centrocercus urophasianus). Both of these grouse are in decline across the western United States, and conservation practitioners are eager to understand

the mechanisms that allow for improved conservation success. Fecal pellets of grouse allow for researchers to understand many mechanisms that may be underpinning the local population demographics, including host demographics (from avian DNA), grouse diet (from plant DNA, via trnL DNA metabarcoding), and grouse microbial communities (from microbial DNA, through 16S metabarcoding). The goal of the research is to explore the methodology of extracting DNA from several different communities found within grouse fecal pellets. In particular, Elizabeth will focus on extracting plant DNA from Sharp-tailed Grouse fecal pellets for downstream dietary analyses and host DNA from Greater Sage-grouse fecal pellets to understand host demographics (e.g., host sex). Extracting host DNA from fecal pellets has been challenging, so this work will uncover the best approach for maximizing host DNA yield for downstream analysis. This work will allow researchers to gain multiple insights from the same fecal pellet and use this information to inform conservation management. Questions of interest to conservation practitioners include how are populations related to one another and how grouse transition their diet and microbiomes when translocated to new environments. Because fecal sampling is a non-invasive approach, this allows conservation practitioners an effective and efficient approach to learn more about the birds they manage for improved conservation success.

Payton Lyons, Applied Mathematics/Economics

Title: Using Partial Differential Equations in 3D sagebrush population modeling
Abstract: Partial Differential Equations are of significant use in most fields. From modeling heat diffusion to creating JPEG images. One of the more prevalent uses is in modeling population dynamics. In this project, we created a stage-structured partial differential equation to understand the growth dynamics of sagebrush populations in the great basin. We used real world data to estimate parameter values and then view the modeling results after that to identify ideal initial planting conditions. This project identified that planting sagebrush in a grid created slightly more efficient growth, however in the end it is indiscernible from random planting.

Kerry Molina, Geosciences

Title: Inclusivity in the outdoors as a way to promote diversity in geoscience
Abstract: The lack of inclusion and diversity is identified as "the single largest cultural problem facing the Geosciences today" (Dutt, 2020). In particular, the outdoor field experiences inherent to many geology courses and field camps may keep under-represented groups from participation. Cultural, financial, and experiential barriers influence under-represented student engagement in outdoor recreation. It is possible to break these barriers by giving opportunities that can lead to confidence and support in the pursuit of field-based sciences. My research will implement a program at Boise State called Making Adventures Possible for All Students (MAPAS). MAPAS was developed at UC Santa Barbara in response to the lack of representation and diversity in outdoor recreation. It is a program that creates opportunities for students from different backgrounds to collectively gain experience in nature which can increase engagement in geoscience. MAPAS will promote an inclusive environment, run by students with little-to-no previous experience in the outdoors. I've spent the last 7 months working on a NSF-funded student board for assessing inclusivity of the geoscience department, that measures are working and what needs to be improved. I conducted faculty interviews and assisted in a student survey. Lack of outdoor experience is one of the biggest barriers. The geoscience students within the department would benefit from an inclusive program that supports participation and building leadership, especially for under-represented groups that have been historically excluded from outdoor recreation. Some students may face cultural barriers to outdoor

experiences, while other people may lack the needed equipment or have physical conditions that limit outdoor engagement. MAPAS will go beyond the geoscience department, it is for everyone. To reach out to students within all the departments takes a lot of time and work. I would use the HERC support to dedicate the time and effort to create this inclusive outdoor program: MAPAS.

The following images showcase the student and their mentor's effort.

Fall 2022 and Spring 2023 HERC Fellows
Research Projects

Allison Muenzer, Materials Science and Engineering

Title: Synthesis of gamma-phase Electrolytic Manganese Dioxide for Use in Aqueous Zinc Batteries
Abstract: Interest in manganese dioxide for use in electrochemical energy storage systems has increased in recent years because it is environmentally friendly, low cost, and enables safer operating conditions. γ-phase electrolytic manganese dioxide (EMD) is of particular interest due to its larger 1x2 tunneling structure that enables greater ion transport and higher specific capacity. MnO_2 can be synthesized from a redox reaction of $KMnO_2$ and $MnCl_2$ and the product can be annealed at 200°C for 32 hours for a phase transformation into γ-phase that is verified with XRD. EMD slurry is used to laminate carbon paper heat treated to 350°C for 8 hours to produce the cathode electrode material assembled into coin cells. Rate studies of commercial EMD showed a specific capacity of ~150 $mAhg^{-1}$ at 0.5C rate, approximately two times greater when compared to synthesized EMD specific capacity of 60 $mAhg^{-1}$ at 0.5C rate. Cycling repeatability improved with the use of synthesized EMD when compared to commercial EMD with less deviation between charge/discharge cycles. EMD has the potential for use in electrochemical energy storage systems once an appropriate dopant used to stabilize the γ-phase can be determined.

Zixi Zhao, Computer Science

Title: A Communicative Fine-grained Privacy Control Framework for Augmented Reality
Abstract: We develop a user interface as part of a privacy control framework for exerting privacy control on Augmented Reality (AR) systems. The AR devices continuously sense the wearer's surrounding environment using cameras and can be a threat source to users' or bystanders' privacy. Our framework projects virtual objects that convey privacy rules intuitively to users and enable revealing those privacy threats as well as improving their privacy-control flexibility. The user first registers privacy needs through standard AR interaction interfaces in the offline stage. Then the user can leverage the AR interfaces using the framework to drive the generation of input control policy through spatial-relation analysis over surrounding physical

objects. The policies are loaded in the online stage to enforce input control rules over the visual information of target physical objects and hide sensitive information. We implement our proof-of-concept application under the ARCore platform and test the system functionality and performance on the Samsung S9 Plus device. Our experiment results reveal several challenges and opportunities for the future study of privacy control of AR systems.

Spring 2023 Fellows

Andrew Altman, Engineering

Title: Sagittal Plane Device Analysis for Infant Product Safety
Abstract: Approximately 15,000 infant injuries occurred in inclined sleep products in 2021. This is likely due to infants often being left unattended while sleeping in products not designed for sleep. Prior research has established that a slouched or flexed trunk posture increases the effort required to breath in adults and infants. This higher demand of breathing due to slumped posture could put infants at a greater risk of suffocation in unsafe products. Currently there is no standardized method of infant body position testing in infant products. To address this, our lab created a 4-segment sagittal plane device. This device aims to provide an accurate and easy way to perform infant product safety testing without the need for testing with real baby participants. My role in this project was determining an analysis method to calculate and validate trunk flexion of the sagittal plane device and compare it to in vivo human subjects data. This was done through assisting with collection and analysis of motion capture data for participants as well as the 4-segment device in 4 different infant products. MATLAB code was created to perform calculations using 3D-vector math, another MATLAB code was used to perform these calculations using a method where the change in distance between the shoulders and ASIS was evaluated to calculate angles for trunk flexion. This data was then analyzed and compared against in vivo participant data. It was found that the changing distance method of analysis produced similar results for the 4-segment sagittal plane device as compared to the participant mean data in the products. This indicates that the changing distance method for calculating torso flexion has less range, producing more consistent values and likely produces values closer to the infant's true flexion when compared to the vector method. The vector method was found to produce variable results compared to the changing distance method.

Rachel Capezza, Biology

Title: Examining Relationships Between Antagonism, Antimicrobial Properties, and Metabolic Profiles of Sagebrush-Associated Microbes
Abstract: The phyllosphere is defined as the aerial parts of a plant which host diverse communities of microbes. This phyllosphere microbiome is an interactive system comprised of interspecific competitive and antagonistic dynamics, often due to the production of antimicrobial metabolites. In addition to influencing overall community structure and host plant health, these metabolites can be isolated and harnessed for biocontrol or medicinal applications. To date, no studies have examined the metabolic properties of microbes isolated from the leaves of sagebrush (Artemisia tridentata). In this study, we selected four microbes isolated from sagebrush leaves to determine their interactive properties when co-cultured in vitro and compare these interactions to antimicrobial properties against E. coli and S. aureus. We hypothesized that the microbes exhibiting antagonism in vitro would express antimicrobial metabolites. The four sagebrush-associated microbes we selected included Aureobasidium pullulans, Bacillus amyloliquefaciens, Cladosporium herbarum, and Filobasidium wieringae. We plated three replicates each of monoculture cultures and pairwise co-cultures

in each possible combination. Initial analysis revealed antagonistic dynamics between B. amyloliquefaciens/C. herbarum and A. pullulans/B. amyloliquefaciens co-cultures. Therefore, we produced crude extracts of these co-cultures and their corresponding monocultures to test against E. coli and S. aureus in a disk diffusion assay. However, no visible inhibition of bacterial growth occurred under these treatments. Nonetheless, forthcoming work using liquid chromatography-mass spectrometry (LCMS) may serve to isolate the mechanism driving growth inhibition of these isolates in vitro. Increasing our understanding of microbial interactions opens the door for myriad real-world applications in agriculture, ecosystem management, and medicine.

Asher Chivvis, Health Studies

Title: Inactivation of E.coli 8739 with Cold Atmospheric Pressure Plasma on Strawberries
Abstract: Foodborne illness and food shortages are a detriment to the normalcy of foreign and domestic populations that can cause widespread harms including diseases and a decline of economic productivity. Produce contaminated with E.coli causes serious risk to the infant, elderly, and immunocompromised population. Since contamination may be widespread, large amounts of fresh produce needs to be recalled as a result. In an effort to combat these issues, alternative methods of produce sanitation need to be looked at. The use of cold atmospheric-pressure plasma against planktonic bacteria on strawberries has proven that it is capable of inactivating a significant amount of the microorganisms with only a 5 minute exposure time (~99.9% reduction). Cold atmospheric-pressure plasma (CAPP) produces reactive oxygen and nitrogen species that result in oxidative damages to any microorganism that comes into contact with them. Since the cause of decomposition amongst most produce is a result of bacterial/fungal contamination, the removal of microorganisms could have a lasting impact on the shelf life of numerous agricultural products in addition to decreasing the occurrence of illness. Therefore it is prudent to explore the effect of CAPP on fresh fruits and vegetables in order to extend the length of time in which these items are viable for consumers.

Gianella Condor, Materials Science & Engineering

Title: Magneto-mechanical properties of 10M Ni-Mn-Ga after micro-peening
Abstract: Since the discovery of magnetic shape memory alloys, the manufacturing of the Ni-Mn-Ga alloy has been refined to minimize the material twinning stress and to maximize the work output under magnetic actuation. However, applications have lagged behind alloy development partially due to fatigue failure via magnetic and/or mechanical cycling as well the difficulty in controlling twin boundary motion. Previous research has demonstrated that a micropeening surface treatment improves fatigue life while maintaining twin boundary motion. In this study, we present a systematic characterization of the Ni-Mn-Ga material's magnetic and mechanical properties as it was affected by varying intensities of this micropeening surface treatment process. We prepared Ni-Mn-Ga sample via mechanical grinding and polishing and recorded the sample's magnetization and stress/strain characteristics as a baseline. We micropeened the prepared sample in its austenite phase via blasting it with glass beads at a specified pressure and duration. The stress and strain properties of the treated sample was measured via a custom micromechanical tester, and the magnetic properties measured via a vibrating sample magnetometer. The twinning stress of the sample increased and the total strain decreased as the pressure of the micropeen surface treatment increased. Optical micrographs indicate that the surface deformation caused by the micropeening treatment altered the surface roughness and also stabilized a fine twin configuration. Furthermore, we discovered that most of the magnetic-field-induced-stress is suppressed after a 30 psi micropeen treatment.

Fall 2022 and Spring 2023 HERC Fellows
Research Projects

Kaitlyn Linder, Physics

Title: Orientations of Galaxy Clusters in the Universe

Abstract: Galaxy clusters are large, gravitationally bound structures, primarily consisting of stars and dark matter. These two components form different shapes, which are oriented differently. Using data from IllustrisTNG, a publicly available set of hydrodynamical simulations, we calculate the 2D shapes from the inertia tensor of these clusters. Based on shapes measured from various methods, we find the misalignment between each shape. From these misalignments, we find that alignments between shapes measured based on individual particle positions tend to be much stronger than those measured with galaxy positions. We also find that shapes measured with these galaxy positions tend to be much more round as opposed to elliptical in shape.

Jeleana Loa, Radiologic Sciences

Title: Addressing the Nationwide Shortage of Radiologic Technologists

Abstract: There is currently a nationwide shortage of radiologic technologists. A 2022 survey conducted by AMN Healthcare found that radiologic technologists topped the list of new graduate allied health professionals hired by facilities thus indicating that radiologic technologists are in high demand. The purpose of this study is to determine by both division (region) and state, on a per capita basis, how many first-time candidates sat for the American Registry of Radiologic Technologists (ARRT) exam for the years 2020-2022. To accomplish this purpose, I examine the national average of candidates taking the ARRT exam per capita by state and division to determine which states and divisions are performing above or below the national average. The ARRT annually publishes data on the number of prospective radiologic technologists that sat for the registry exam by state. The data published for years 2020-2022 were averaged and then compared to the 2020 United States census data to determine the number of candidates produced in each state and in the nine separate United States census divisions on a per capita basis. The study found that during 2020-2022, divisions one through eight produced one ARRT registry candidate for every 27,033 residents. Division nine (Pacific division) was an outlier producing one ARRT registry candidate for every 50,527 residents. The national average for the time period in question was one ARRT registry candidate for every 29,295 residents, meaning the Pacific division is not producing as many ARRT registry candidates. This information may be used for education and advocacy purposes as well as a basis for further inquiry. Existing radiologic technology programs in states and divisions producing less ARRT candidates per capita could utilize this data to advocate for increased resources. Professional organizations and institutions could advocate to state and federal leaders and policymakers for increased resources for existing and new programs dedicated to producing radiologic technologists in order to keep pace with a shifting and growing population.

Jacob McKeever, Health Studies

Title: Vaping Prevention and Control Interventions Among Adolescents Within the United States: a Review of Present Literature

Abstract: In approximately 18 years since its emergence in the United States, electronic nicotine delivery system (e-cigarettes) usage (also known as vaping) has gained extreme popularity, especially among adolescents and young adults. Negative physiological effects of vaping or e-cigarette use among individuals is well-documented. Vaping has become increasingly widespread, and reached epidemic levels, crucially within the adolescent and young adult demographic aged 13-18 years old. Due to this increase and the negative health outcomes that vaping induces, prevention and control intervention programs have been utilized to

curb usage rates among adolescents and young adults. While analysis has been conducted on individual program effectiveness, gaps exist when comparing the effectiveness of programs. In order to fill this gap, a systematic literature review utilizing Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocols was conducted. The goal of the review was to summarize current programs used for vaping prevention and intervention control, determine what prevention and control intervention programs are most effective, and suggest best practices for vaping prevention and intervention control and areas for further research. Two databases (PubMed and Web of Science) were searched in March of 2023. The target population was adolescent and young adult demographic aged 13-18 years old.

Cheyon Sheen, Civil Engineering

Title: A Step toward Resolving Spatiotemporal Distribution of Suspended Sediment Concentration using Remote Sensing

Abstract: It is critical to study Suspended Sediment Concentration (SSC) to improve our understanding of the impacts of wildfires, climate, and anthropogenic on the riverine environments. The processes that contribute to SSC occur over a range of spatiotemporal scales making it difficult to continuously measure and monitor. Traditional methods (e.g., field measurement) require significant resources and often lack the spatial and temporal resolution that is needed for important yet smaller-scale systems like streams. In this study, we create an open-source and low-cost method to estimate SSC using remotely sensed data. Our study aims to elucidate if a machine learning (ML) model is capable of estimating SSC from multispectral imagery using a dataset collected in the laboratory. Another objective is to determine which ML model most accurately estimates SSC. Our methods involve testing and comparing two Machine Learning (ML) models: Random Forest and Linear Regression. Preliminary results indicate that the Random Forest model has the capability of extracting the SSC signal from the imagery and providing superb agreement between experimental and ML-generated data (R2=0.99). Further, our results from the Linear Regression model indicate that the relationship between multispectral imagery and SSC is non-linear and requires a more robust ML model (low correlation of R2= -.71). Continuing work will compare these results with other ML models to develop a cross-validated method for widespread usage in SSC detection. This study contributes to a larger framework, and with a validated model we will be able to quantify the effects of SSC on the entire Snake and Columbia River system. Implications of this research include improving our understanding of SSC and detection methods that augment existing methodologies as tools for stakeholders, government agencies, land managers, and citizen scientists.

Amethyst Tagney, Biology

Title: Pollination biology of a rare and threatened endemic plant: evaluating the flower constancy of Mulford's milkvetch insect visitors

Abstract: The biodiversity of our planet is in peril. Although this crisis impacts all organisms, it is especially concerning regarding plant-pollinator interactions. Flowering plants play a critical role for ecosystem functioning, human and animal nutrition, and offer much-needed habitat for many organisms. However, human impacts such as urbanization, climate change, unsustainable agriculture practices, and the spread of invasive plants, put these plants-and their pollinators-at risk. One such example is Astragalus mulfordiae, a rare and threatened plant endemic to southwestern Idaho. To learn more about the decline of A. mulfordiae and to develop effective conservation strategies, it is important to understand the pollinator relationships it relies on. This includes identifying which insects visit its flowers, and which are the most important for its pollination. Flower constancy is the tendency of individual pollinators to visit a single kind of flower, and

pollinators with high flower constancy can be especially beneficial to plants by increasing the chances they receive pollen from their own species. In this project, we investigate whether insect species that visit A. mulfordiae flowers differ in their flower constancy. To evaluate this, we examined pollen collected off insects foraging at A. mulfordiae flowers. We first created a pollen reference library using pollen samples from surrounding plant species in A. mulfordiae habitat. We then used this library to identify the pollen grains on each insect, with flower constancy measured as the ratio of A. mulfordiae pollen to other pollen types. Our findings will provide insight into which insect species are most important for A. mulfordiae pollination and will help inform land managers who manage A. mulfordiae habitat areas.

Thomas Wenzel, Kinesiology

Title: Surface, but not Age Impact Lower Limb Joint Work During Walk and Stair Ascent
Abstract: During common locomotor activities, such as walk or stair negotiation, older adults exhibit unfavorable lower limb biomechanical changes, including diminished joint torque and power, and proximal mechanical work redistribution that may increase their fall risk. To investigate age-related differences in lower limb work, twelve young (18 to 25 years) and 12 older (> 65 years) adults performed a walk and stair ascent task on a normal, slick, and uneven surface. For each walk and stair ascent trial, synchronous 3D marker trajectories and GRF data were collected. Stance phase positive limb and joint work, and relative joint work were submitted to statistical analysis. Ascending stairs required more positive work than the walk, particularly from the knee, which may increase fall risk. Yet, both walking and ascending stairs over a challenging surface required more, proximally distributed work.

Matthew Wilken, Geosciences

Title: Studying the seasonal fluctuations of dissolved oxygen levels and how various environmental parameters influence them in the context of Dry Creek.
Abstract: The consequences of water scarcity can be devastating, as was experienced by some of my family members who lived through the Cape Town water crisis in 2018. Dramatic changes to lifestyle, including limiting showers to once or twice a week, were required as the community banded together to reduce water usage in order to avoid day zero. My appreciation for water security drove me to take an interest in water science and research that pertains to how water availability and quality can affect the local environment. The Dry Creek tributary plays an important role in a larger ecosystem downstream and is the perfect location to better develop my research interests. I have begun preliminary research in the Fall of 2022, and hope to continue monitoring how changes in temperature and other environmental parameters can affect the dissolved oxygen (DO) levels in Dry Creek. The concentration of dissolved oxygen directly impacts the native and genetically pure Red Band Trout, which, in the future, may come under increased stress as a result of climate change and population growth. This experience will continue to build necessary field and analytical skills that are highly valued in the industry.