HURA and Urdea Recipients 2023-2024

Student	Project Title	Abstract	Faculty Mentor	Faculty Department
Avery Bell	Machine Learning Classification of Lung Cancer Using Thermal Liquid Biopsy	Thermal liquid biopsy (TLB) is a growing biochemistry field that holds potential to revolutionize the way diseases are detected and diagnosed. TLB results are derived from the thermal denaturation of human blood plasma and provide a characteristic signature termed a thermogram. Thermograms present differently depending on the health status of a patient. Previous HURA-funded research has resulted in the collection, preparation, and storage of several IRB-protected thermogram datasets. These datasets represent different study cohorts across several diseases including melanoma, lung cancer, and myocardial infarction. The proposed project for this application is to utilize the data structures resulting from earlier HURA work to prepare an analysis of the TLB lung cancer dataset. This study aims to determine if random forests and neural networks can be trained to classify lung cancer thermograms with the goal of distinguishing controls from lung cancer patients as well as differentiation of lung cancer type. The conclusion of this project will result in a cross-validated machine learning model that can classify lung cancer using thermogram signatures. This project provides the groundwork for explainable artificial intelligence and variable importance frameworks to be applied to finalized models for evaluation of what thermogram features are associated with lung cancer presence and type.	Robert Buscaglia	Mathematics and Statistics
Sierra Binney & Andrea Wrenn	Carbon Emissions Removal Options in Northern Arizona	In an increasingly threatening world climate, scientists look toward carbon capture and storage (CCS) processes for hope in climate change mitigation. Among the collection of carbon capture approaches is direct air capture (DAC), in which a material or solvent absorbs the greenhouse gas carbon dioxide from ambient air. After capture, the carbon can be permanently sequestered in a stable mineral state so as to completely remove carbon dioxide emissions which are already present in the atmosphere. This project continues the exploration of CCS initiated in the 2022-2023 academic year in which two students will investigate a realistic approach to DAC and the mineralization of captured carbon as a potential CCS solution. A fourth-year engineering student will lead the characterization of materials that can capture ambient CO_2 and release into aqueous solution. In collaboration, a third-year earth science student will collect, document, process, and react naturally-occurring alkaline minerals local to Arizona with CO_2 in aqueous solution to study their potential for permanently sequestering captured carbon in a stable state through economical means.	Jennifer Wade	Mechanical Engineering

Kayla Blair	Creating NAU's First Undergraduate Course On The Significance Of Science Communication	One of the most important skills for future scientists to cultivate is the ability to communicate their science. Scientists will be increasingly expected to have the proper techniques and methods to communicate the work they are doing with myriad audiences, from K-12 students to people who hesitate to believe the evidence that scientists present. These communication skills are particularly vital to scientists and citizens in the current socio-political climate where misinformation is abundant. NAU currently offers a Graduate Certificate in Science Communication, but has little resources present to assist undergraduate students in developing their science communication skills. This project aims to generate a brand new undergraduate curriculum focusing on the importance and the need of Science Communication, to be implemented at NAU in a seminar-style course first, and to appropriately prepare students to communicate their science in the most effective ways possible to a variety of audiences. After completion of the first seminar course, and a reflection of the success of the course, we plan on proposing the course to the General Studies program so we can offer it to the whole STEM student population. The curriculum will address 1) the different mediums to be used to communicate science and engage the public, 2) how to promote diversity and inclusion when communicating science, 3) how to correctly and appropriately portray science and scientists depicted in popular media, and 4) how to value and communicate science from different cultural backgrounds, including Indigenous and Western backgrounds.	Lisa Chien	Astronomy and Planetary Science
Nicholas Bushroe	Exploring Novel TE-Host Dynamics Across Squamate Evolution	Transposable elements (TEs), mobile DNA sequences that play a crucial role in the structure and function of the genome, comprise a significant portion most known animal and plant genomes. Historically, studies of these mobile elements have been primarily focused on mammals, which have relatively low diversity of TEs (Boissinot et al., 2019). However, reptile genomes, specifically squamates, one of the most diverse orders of reptiles, are far richer in TE diversity (Boissinot et al., 2019). Investigations have found that TE movement drives mutations in host genomes, which in turn may drive evolution and the development of new traits within a lineage (Boissinot et al., 2019). This project will provide important insights into how TE-host dynamics drive squamate evolution by exploring the relationship between the development of traits at a species level and the abundance and activity of TEs across squamate lineages. To better understand this relationship, we will develop a database of traits observed in various squamate lineages, identify which of these traits can be used to reasonably quantify phenotypic variation across all squamate clades, and compare this to data on TE abundance, generated using sequences from over 90 squamate species.	Marc Tollis	School of Informatics, Computing, and Cyber Systems
Rebecca Chavez	Transposable Elements and Cancer	Transposable elements promote genome instability, which can drive diseases like cancer. This phenomenon has not been researched regarding how transposable elements impact the overall cancer resistance of a species. Types of transposable elements present in the genome and cancer prevalence vary greatly between species. By using the average percent divergence of transposable element families and the cancer prevalence of each species, I can perform a regression analysis to assess if there is a statistically significant relationship between these two factors.	Marc Tollis	School of Informatics, Computing, and Cyber Systems

Dante Chea Robiou	Comparison of Mycorrhizal Communities in Pinyon Pines One Year After Fire Disturbance	Pinyon pines (*Pinus edulis*) are a foundational species of cone-bearing trees in the American Southwest (ASW). They provide habitat, vegetative cover, watershed protection, and nutrition to many species of plants & animals. They are known to be mycorrhizal partners, forming mutualistic relationships in their roots with fungi where they exchange the products of photosynthesis for water and nutrients. Pinyons depend on their mycorrhizal relationships more when under stressed conditions and can struggle to grow & thrive without these relationships. In the summer of 2022, a common garden experiment near Sunset Crater National Monument in Northern Arizona was damaged by two wildfires. Shortly after these fires, a team from the Gehring Lab was able to go to the site, assess tree mortality and collect soils to assess the survival of the mycorrhizal fungi. Using these samples and a series of new ones collected during this project, I will compare the status of pinyon's mycorrhizal fungal communities one month versus one year after the fire to assess their recovery. I will do this by first sorting different morphological types of fungal partners via visual traits, then using genetic sequencing to identify the species of these fungi and comparing those present in the second sample collection to those present in the 2022 collection. This will help us understand how fungi recover from these disturbances and if we need to help these forests reestablish themselves via inoculating the soil with mycorrhizal fungal partners, or if they are capable of the recovery needed to survive.	Catherine Gehring	Biological Sciences
Alyssa Cherow	Analyzing Ponderosa Pine Growth Rates and Resin Ducts on the Coconino National Forest	Throughout the Southwest, ponderosa pine face dynamic conditions due to ecosystem disturbances that are accelerated by climate change. Ecological resilience is a term that describes an ecosystem's ability to endure change and retain the same structure as before (Holling 1973). Trees that face stressors such as competition are consistently less resilient, therefore less likely to overcome ecosystem disturbances. Prevalent examples of ecosystem disturbance in the Southwest United States are bark beetles, native insects that have the potential to cause widespread mortality. Silvicultural treatments can be implemented to effectively decrease competition and improve the overall health of a stand. This study will use ponderosa pine increment core samples collected from treated and untreated stands on the Coconino National Forest. Both growth rates and resin ducts are important markers that reveal information about a tree's ability to overcome disturbances. Growth rates are a visual measure of the tree's annual growth, while resin ducts are the tree's primary defense mechanism against insects and pathogens (Vazquez-Gonzalez et al. 2020). The purpose of this study is to compare tree growth rates and resin ducts to determine both factors' response to treatments. This research will expand on current knowledge to reach conclusions about resilience markers in ponderosa pine, potentially aiding in management for increased resilience to bark beetles and contributing to future research.	Kristen Waring	School of Forestry

Mallory Decker	*Pinus edulis* Resistance to Drought under Demethylation Treatment	Climate change has raised temperatures in the arid environment of Northern Arizona, resulting in an increase of droughts and drought severity (Mueller et al., 2005). With increasing drought events, there is a growing need to study the physiological and morphological traits of drought tolerant *Pinus edulis* . Studies have shown that subjugating woody plants to a demethylation treatment aids in the expression of drought resistant traits, increasing their likelihood to survive in drought conditions (Eckert et al., 2020; Browne et al., 2020). I will apply this demethylation treatment method to *Pinus edulis* seedlings while also exposing them to a drought treatment. The seedlings come from four different sites, two sites at the North Rim of the Grand Canyon that have a cold climate and high elevation, as well as two sites in Sedona, Arizona that have a warmer climate and lower elevation. These extreme populations will be used to see if the maternal climate of seedlings influences drought resistant expression. By observing their growth in both above ground productivity and root development, I predict that Sedona seedlings in the control group will produce more drought resistant traits than the other demethylated and controlled groups, due to that population being exposed to a droughted climate in previous generations. I also predict that the demethylation treatment will reduce this difference in resilience between the Sedona and North Rim seedlings. The results of these two predictions will aid in the restoration of pinyon woodlands by informing whether resistance is genetic or epigenetic.	Amy Vaughn Whipple	Biological Sciences
Charlie Dors	Narrative Inquiry of Undergraduate Student Experiences in a Gender Inclusive Living Community	In an attempt to create a safe and supportive learning environment for Gender Diverse Students, universities have implemented Gender Inclusive Housing Communities, however little information has been collected to establish whether these programs are helpful and achieve their intended purpose. This project will utilize qualitative narrative inquiry to document the experiences of Gender Diverse Students who have lived in Northern Arizona University's Gender Inclusive Housing and how their university experience has been affected by current resources and support systems available for this community of students. Ten undergraduate students who identify as Gender Diverse (Transgender, Non-Binary, Two-Spirit, etc.) who have lived in GIH at NAU will be interviewed utilizing the cycle of collaborative inquiry, in a total of three interviews. This data will be analyzed to identify experiences as a Gender Diverse undergraduate student at NAU, which resources are most often utilized, and where students feel gaps in support. This project will be beneficial to universities with existing programs looking to make improvements, universities planning their own programs, or outside resources and support services on how they can fill the current gaps that exist.	Victoria Damjanovic	Teaching and Learning
Emma Elsner	Monarch Caterpillar Performance on Native, Non-native, and Exotic Milkweed Species	The monarch is a widely known and appreciated butterfly in North America, but it's future is at risk. Milkweeds are crucial to the lifecycle of monarchs because their leaves serve as a site for laying eggs and are the sole food source for the caterpillars. Milkweeds are also a major source of nectar for not only monarch butterflies but many other pollinators. Both milkweed and monarch populations are in decline mostly due to habitat loss, and since Arizona is part of the migratory path of western Monarchs, it is imperative that there is a substantial population of milkweed for them to utilize here. For this project, I will test 7 species of milkweed that are native to Arizona and 2 that are exotic to determine which species serve as the best host for monarch caterpillar development. I will also determine the host plant from which the Monarch feed upon as a caterpillar and test whether that influences their offspring's performance on the milkweed species. This project is ambitious in that most larval preference studies in the past have only looked at monarchs on a maximum of four milkweed species while I will be looking nine different milkweed species. It is expected that caterpillars will perform better on some species of milkweed than others, and that the host plant species from which the caterpillars were collected may also play a role in their offspring's preference on various milkweed species.	Richard Hofstetter	School of Forestry

Olivia Fisher	Simulation of Stroke in an Advanced Flow Model for the Development of Nnew Treatment Options for Patients	Stroke accounts for over 4.6 million disabled people in the United States. Of the nearly 800,000 Americans who have a stroke per year, 87% experience ischemic stroke1, of which 49%-86% are attributed to either large vessel occlusions (LVO) or medium vessel occlusions (MeVOs) from blood clots (thrombus) in the brain. 2,3 Mechanical thrombectomy, via a stent retriever or aspiration catheter, is now the standard of care for eligible patients who experience ischemic stroke. 4–6 While mechanical thrombectomy has progressed dramatically over the past few years, existing devices suffer from significant limitations.[1–5,6-7] High performing bench-top models and synthetic thrombus capable of simulating human conditions are needed. Advancements in this area will also help reduce the dependence on animal research. Inclusion of synthetic thrombus within the bench-top model allows for holistic evaluation of cerebrovascular disease, including the complexities of thrombi including calcification and varied dimensions. This project plan includes the creation of synthetic thrombi and incorporation into benchtop vessel models of human anatomy. Model revisions will be created using newly-identified biomaterials printed with the Bioengineering Devices Lab's (BDL) 3D-printer. Thrombi models will be created using synthetic polymer materials. The benchtop model and synthetic thrombi will assess the effectiveness of a new line of stroke treatment devices. The NAU Urdea grant would provide undergraduates with experience in design, implementation, and testing. The focus of this research is two fold: 1) reducing patient morbidity and mortality from strokes and 2) providing undergraduate students with experience in innovative translational research opportunities.	Timothy Becker	Mechanical Engineering
Claire Gibson	Into the Antarctic: Accessible Science Communication for Ecological Studies in Antarctica	The National Science Foundation's McMurdo Dry Valleys Long-Term Ecological Research (MCM LTER) and Northern Arizona University are at the forefront of ecological and climate research in extreme environments. However, research that occurs in the Antarctic is often intangible to university students and the broader public. Additionally, science communication is not always accessible or approachable to the public who may be hard of hearing or sight. I propose to create two distinct science communication media pieces. One media piece will be audio based and aired on KNAU, and the other visually based which crosses the intersection of art and science. These media components will relate information about MCM LTER ecological research, climate change, and how studying life in extreme environments can inform us about life elsewhere in the Solar System and Universe. Methods for this project include conducting field interviews with MCM LTER scientists and working with two other professionals in science communication to learn the best techniques for communication and to get my media components published. I expect to find that by creating two accessible media pieces, a broader and more diverse audience will be able to engage in the science of MCM LTER.	Mark Slavatore	Astronomy and Planetary Science

Makayla Grandpre	Detecting New Mexico Meadow Jumping Mice through eDNA	The New Mexico meadow jumping mouse (*Zapus hudsoniusluteus*) is an endangered obligate riparian species that lives in the southwestern United States. It uses a habitat composed of tall, dense herbaceous vegetation along continuously flowing water. This species is listed as Endangered under the Endangered Species Act because of habitat loss from livestock grazing, recreation, wildfire, and changing climate. Land managers need non-invasive methods of identifying the presence of the species; currently, track plating is the only method but it is time- and labor-intensive. I propose to develop a new rapid and less expensive field method to identify presence using environmental DNA (eDNA). Previous work has confirmed the detection of jumping mice through eDNA swabs from plants but not the sampling effort needed. On the Apache-Sitgreaves National Forests, I will swab riparian vegetation along 12 streams (6 with the presence of New Mexico meadow jumping mice, 6 without) comparing a cluster versus continuous transect approach by varying distances among samples (quadrats) and testing evenly spaced sampling for line transects versus aggregates of samples for cluster sampling. I will also identify sampling intensity, defining 1 sample as 1 swab of 1 plant and sampling 3 plants per 0.5 m2 quadrat placed adjacent to the stream. The transect will be 500 m with 60 samples taken from each stream. I will then determine the number of samples and sampling method that gives the best results of eDNA testing. This method will provide another non-invasive approach to detecting jumping mice.	Carol Chambers	School of Forestry
Jenna Hays	Live Load Distribution Analysis of a Coconino County Girder Bridge	Changes in vehicular loading over time have caused some highway bridges to rate poorly when considering modern larger or overweight trucks, which leads to load posting and bridge restrictions that in turn lengthen travel routes. A potential way to allow overweight vehicles to cross these bridges would be to increase the load rating by utilizing a more accurate live load distribution factor generated from field testing the in-place structure. The focus of this study is to determine the live load distribution factor for a girder bridge in Coconino County using results from live load testing. The field testing will utilize strain gauge instrumentation owned by the CECMEE Department that will be temporarily attached to the bridge for data collection. Results will be compared to the live load distribution factor calculated using the American Association of State Highway and Transportation Officials (AASHTO) bridge design code to determine the level of conservatism. An improved live load distribution, and therefore load rating, can likely be realized using the field test data.	Ben Dymond	Civil Engineering, Construction Management, and Environmental Engineering

Isabela Herckes	Preserving Childhood: How Child Maltreatment Should Be Handled with the Child's Best Interests in Mind	Child maltreatment such as abuse and/or neglect is a national epidemic and its presence in Flagstaff is no exception. Cases of suspected child maltreatment detected in the Flagstaff Medical Center Emergency Department are referred to law enforcement and child protective services, with possible final resolution through the city or county attorney's office. Children identified with possible signs of maltreatment often find themselves lost in a system of adults who, though meaning well, may not always know the best way to handle the situation. Emergency department staff, law enforcement, social workers, and attorneys approach these cases from different perspectives and for different purposes. Each group may have been trained differently. This project will identify the best strategies for the handling of cases of suspected child maltreatment by four major categories (emergency room staff, law enforcement, social workers, attorneys) while protecting the child's best interests, namely their mental health. Then, the current structure of the Flagstaff system for handling cases of child maltreatment will be examined, and recommendations will be made for the improvement of the system.	Beth McManis	School of Nursing
Alexa Knippenberg	Assessing Gender Differences among College Students that use Cannabis and Nicotine to Cope with Stress	The purpose of this study is to assess gender differences in college students who use nicotine and cannabis to cope with stress. The goal is to better understand how students cope with stress using substances and how this may differ by gender identity. Prior studies have found that perceived stress differs from men to women and additionally from sexual and gender minorities (Hoyt et al., 2021). Research has also found that distress intolerance is related to higher cannabis use especially amongst women who report using it to cope (Bujarski et al., 2012), however, not much other research has been conducted looking at gender differences and how it may affect nicotine and cannabis use. The proposed study aims to investigate how nicotine and cannabis use to cope with stress may differ by gender identity among college students.	Tara Bautista	Psychological Sciences
Jack Kohm	Investigating the Potential Progenitors of Dark Matter Deficient Galaxies: A Study on the Formation of Tidal Dwarf Galaxies	Recent observations of two dwarf galaxies, NGC 1052-DF2 and NGC 1052-DF4 (DF2 and DF4 in short), suggested the absence of dark matter that is typically present and necessary for galactic cohesion (van Dokkum et al. 2018, 2022). These results have challenged our current understanding of galaxy formation and the role of dark matter in it. On the other hand, tidal dwarf galaxies (TDGs) are believed to form from material stripped off during the interaction between two or more galaxies (Duc & Mirabel 1994). They are also considered to be dark matter free or have low dark matter content. However, the relation between TDGs and dark matter deficient galaxies, like DF2 and DF4, requires more study. With this project, we propose to use state-of-the-art simulations and NAU's Advanced Research Computing (ARC) to model the formation of TDGs. First, we will design our simulations to produce TDGs in the bridges and tails of merging galaxies. Second, we will refine our models and replicate the observed properties of DF2 and DF4, such as their low velocity dispersion, elongated shapes, and peculiar gas kinematics. We will then test our hypothesis whether TDGs and dark matter deficient galaxies share a common origin. The results of our simulations will help us determine whether DF2 and DF4 are anomalous, or a new class of galaxies with low dark matter content. Finally, it will provide some insight into the formation mechanisms of TDGs, the role of dark matter in their formation, and a new perspective on galaxy formation.	Lisa Chien	Astronomy and Planetary Science

Alexandra Lee	To Apply or Not to Apply: An Examination of Job Seekers' Attitudes Towards Felon-Friendly Organizations	With 8% of Americans being ex-felons, it is not surprising that many studies have examined ex-felons' job experiences. Yet there are very few studies that have investigated the job experiences of those who work or are applying to work for felon-friendly organizations (i.e., those who hire ex-felons). The purpose of this study is to examine whether job seekers are less likely to apply to felon-friendly organizations, and if so, can felon-friendly organizations take some measures to increase job seekers' interest. Guided by stigma and expectancy theories, my research extends Young and Keech (2022) work on ex-felons who found that consumers were less likely to patronage a business if they employed ex-felons, but this could change if the organization introduced positive messaging. In the current study, I hypothesize that job seekers are less likely to seek a job from a felon-friendly organization. Additionally, job seekers' attitudes will be more positive if the organization presents a justification for employing ex-felons. Hypotheses will be tested over two studies using an experimental design with two samples (student, adult working) that will examine perceptions of job seekers for (a) felon-friendly vs. non-felon-friendly organization; and for felony-friendly organization's only (b): no messaging vs. positive messaging. Results from this study could shape perceptions of ex-felons to job seekers in a more positive light, whilst benefiting the organizations by providing a more diverse and robust working population. This interdisciplinary research will inform both industrial-organizational psychology and criminal justice in the best practices associated with felon-friendly organization's hiring methods.	Ann Huffman	Psychological Sciences
Mia Marotti	Modifying MS2 Virus-Like Particles (VLPs) as a Platform for Human Papillomavirus (HPV) Vaccine Development	Globally, cervical cancer serves as one of the leading malignancies in women, with Human Papillomavirus (HPV) taking responsibility for most of the fatal diagnoses. HPV is especially prevalent among Native American women, with twice the incidence of cervical cancer and mortality rate than that of white women from 1999 to 2009 (Lee, et al). Current HPV vaccines use virus like particles (VLPs), which are self-assembling multivalent structures that mimic the conformation of certain native viruses but lack a viral genome, making them noninfectious. Bacteriophage MS2 VLPs are easily and commonly produced for HPV vaccines, since they spontaneously self-assemble and are highly amenable to modifications. Current HPV vaccines use the L1 HPV capsid protein, but a vaccine using the L2 HPV capsid protein could offer protection against more strains. Modifying the MS2 VLP to express an HPV-L2 consensus peptide sequence at the N-terminus site will allow for this protection. This modification is accomplished through MS2 plasmid design in polymerase chain reaction (PCR). Current steps include preparing and modifying the pDSP62 plasmid, using PCR primers and probes, synthesizing MS2 VLPs with the modified plasmid, and characterization via gel electrophoresis and sequencing. Future steps include finalizing PCR training and protocols, continuing MS2 VLP synthesis, combining projects with another student modifying the AB loop site with Tyrosine, and further characterization of the modified MS2 VLP. The final vaccine structure will include expression of the HPV L2 antigen in the N-terminus, and a modified AB loop for attachment of triazabutadiene linker for mass antibody response.	Naomi R. Lee	Chemistry and Biochemistry

Levi Mault	Uncovering the Spatial Patterns of Arctic Heatwaves and their Connections to Population Geography	I aim to categorize the thermal regime in the northern polar regions to gain a better understanding of how heatwave anomalies are affecting different land cover types and explore potential correlations between extreme heat events and population geography, including population data and mortality rates. I will use remote sensing data from NASA's MODIS sensors and Google Earth Engine to process and analyze the large datasets. By examining the correlation between extreme heat events and population geography, I hope to identify areas where vulnerable populations may be more susceptible to the impacts of heatwave anomalies. Using spatial patterning, I will showcase the extent and magnitude of the impact of these heatwave anomalies, which would be critical for developing effective management strategies for the increasingly vulnerable ecosystems. The expected outcomes of this research are a better understanding of the thermal regime in the northern polar regions and potential correlations between extreme heat events and vulnerable human populations.	Scott Goetz	School of Informatics, Computing, and Cyber Systems
Elyse Policastro	Are There Sex Differences in the Cell Stress Response Pathways?	Advanced age substantially increases the risk for a host of diseases including cardiovascular disease, Alzheimer's disease, and cancer, and this increased risk is tied to dysfunction of pathways that respond to cellular stress. One potential reason for this dysfunction is a gradual shift in the redox state toward a more oxidized cellular environment potentially disrupting cellsignaling. Nrf2 is an important player in the protection through controlling expression of a host of genes involved in cellular detoxification and antioxidant defenses. Our lab was the first to demonstrate Nrf2 activation in response to acute exercise in humans, and in agreement with animal data, showed age-related impairment in exercise-induced Nrf2 signaling. The next study from our lab demonstrated that Nrf2 signaling can be improved in young and older inactive men and women through moderate exercise training. However, the data from this study indicated some sex differences, that were unexpected. The proposed project will follow up on those preliminary results and compare basal nuclear Nrf2 levels in 15 men and 15 women, 60y or older. Because we have also demonstrated a link to physical fitness, we will measure aerobic capacity as a possible modifying variable. A better understanding of possible sex differences in this pathway would inform future studies and could lead to interventions tailored specifically to either sex.	Tinna Traustadottir	Biological Sciences
Isabella Qualls	Whitebark Pine Resistance to White Pine Blister Rust in Relation to Climate, Elevation and Geography	Whitebark pine (*Pinus albicaulis*), a five-needle pine, naturally grows in western U.S and Canada, but is affected by mountain pine beetles, fire regimes, climate change, and white pine blister rust. These threats have caused severe damage to the species, which has been recently listed as endangered. Restoration efforts are limited due to the time it takes for the tree to mature and the lack of resistance, primarily to blister rust. The fungal disease is a non-native pathogen that has had a significant impact on all white pine species. The five-needle pine is a keystone species for high elevation ecosystems which is a concern as infection spreads. This project will investigate white pine blister rust infection in whitebark pine individuals and populations. I will be examining specific resistant genes and comparing those to samples located in different elevation and geographic regions. The results of this project may find that there is a correlation with susceptibility between climate, elevation, and geographic regions. This information will be useful for restoring these foundation forests.	Amanda De La Torre	School of Forestry

Jillian Raab	Andesitic Volcanoes in the San Juan Volcanic Field	This project proposes to analyze the formation and crystallization process of magma bodies from the Jacks Creek volcano. These bodies can appear different based on temperature gradients between the upper and lower parts of the earth's crust during development. This project may elucidate how the magmatic systems under earth's surface interact with their surroundings. This knowledge will assist geologists in comprehending the formation of andesitic rocks. Andesitic rocks are the intermediate rock that forms between mafic rocks that are high in magnesium and iron, and felsic rocks that are high in silica and other low-density elements. They present as a dalmatian color. Through understanding the magmatic systems that form andesitic rocks, geologists may locate other areas in the United States that could produce andesitic rocks. Locating andesitic rock deposits is beneficial to construction since it can serve as a filling material for roads and railways, the andesite is used to make the base for roads and rail, by packing the material into holes and even filling in cracks in the ground, so that the construction can commence on a smooth surface improving the integrity of the road or railway.	Casey Tierney	Geology
Annika Revis	Impact of Recreation Related Disturbance on Fungal Endophytes in *Calamovilfa longifolia* Along a Disturbance Gradient in Browns Canyon National Monument	On February 19, 2015, President Obama proclaimed Browns Canyon a National Monument. Located between Buena Vista and Salida, Colorado, Browns Canyon represents one of the only riparian ecosystems along the Arkansas River that remains relatively undisturbed. Every year more than 200,000 people take guided or private rafting trips through the stretch of river. The large amount of ecotourism brought in by watersports and sightseeing is likely affecting the natural taxa in a negative manner. It is common to camp at one of the dispersed, designated campsites along the river while traveling through the most popular stretch of river. Calamovilfa longifolia is a type of grass native to the area, that is quite abundant in these campsites. Endophytes are organisms, especially fungi, that live mostly asymptomatically inside of plants, but can also affect plant growth. By isolating the endophytes present in this grass in various spots along the river, one can see if the vast amount of ecotourism is influencing whether these endophytes are pathogenic or beneficial. To do this samples will be taken from a variety of campsites ranging from small to large human disturbances in addition to samples taken at different distances from these campsites. This way the data can directly correlate to the amount of human interaction the plant has experienced. After isolating these endophytes, molecular sequencing will be done on them to find out the taxonomy of these organisms and discover the potential relationship between the plant and endophyte.	Catherine Gehring	Biological Sciences
Colton Roberts	Reduction in Rainfall's Effect on Reproduction and Survival in the Dung Beetle, *O. gazella*	One of the most pressing issues in the Southwest region of the United States is decreased rainfall as a result of climate change. The shift in rainfall can have detrimental effects to species in this area, like the dung beetle Onthophagus gazella. Dung beetles are important for ecosystem services like pollination, nutrient cycling, and seed dispersal, so negative effects from climate change could lead to ecosystem wide changes. I propose to study how decreases in rainfall will affect breeding behavior and offspring development in O. gazella. I will collect local populations of O. gazella and expose them to three different moisture treatments in lab colonies. In reproducing adults, I will measure brood ball burial depth, number of brood balls produced, and brood ball mass. Then I will rear offspring in the moisture treatments of their parents and measure emergence time, survival, sex, and body size. I hypothesize that decreased moisture will reduce adult reproductive traits and decrease offspring survival and body size.	Amanda Wilson Carter	Biological Sciences

Laney Staples	Identifying Morphotypes and Alternative Mating Strategies of Both Sexes of the Gregarious Cockroach, *Gromphadorhina portentosa,* Using Morphology and Behavioral Observations	Cockroaches are considered pests and nuisances, but there areover 4000 species and have an evolutionary history dating back to at least 300 million years ago. There is huge variation between species in size, shape, life histories, and behaviors. Most species are gregarious, provide parental care, and may have personalities. The cockroach has been severally overlooked in research with most information about them concerns pest control and male aggressive behaviors. There is scant information regarding females, their morphotypes, and their behaviors. Our research goal is to define morphological differences in the sexes and associated behaviors in the Madagascar Hissing Cockroach *Gromphadorhina portentosa* .We will measure all adults with specific external markers as guides. Then we will see if the data cluster to define different male and female morphotypes. Then we will set up different social treatments to see if there are different mating strategies associated with the morphotypes. This species makes a great model system because they are easy to manage in a lab environment and we assume their behaviors are similar to vertebrate species.	Rebecca Beresic-Perrins	Biological Sciences
Abigail Stoecker	Effect of Rhamnolipids on Bacterial Biofilms and Tissue Regeneration in an In Vitro Wound Assay	Antimicrobial-resistant infection is a pronounced issue in the United States, with 2.8 million individuals being infected in 2019 ("National Infection," 2021). These infections are often very difficult to eradicate due to the secretion of microbial biofilms by bacteria and other pathogens (Bardsley et al., 2021). Because of this difficulty, treatments for antimicrobial infections are often expensive, with the total cost estimated at $4.6 billion every year ("National Infection," 2021). Rhamnolipids, due to their biocompatibility and biosurfactant properties, have been shown to have antimicrobial effects (Thakur et al., 2021). I am interested in researching whether rhamnolipids can help disrupt bacterial biofilms of methicillin-sensitive Staphylococcus aureus (MSSA), while also promoting tissue regeneration.	Robert Kellar	Biological Sciences
Colleen Ung	Phylogenetic Analyses of Coronaviruses and Paramyxoviruses from North American Bats	Bat-borne viruses have been associated with several highly virulent zoonotic diseases in recent decades, from Marburg virus disease to COVID-19. Among the viral families harbored by bats, coronaviruses (CoVs) and paramyxoviruses (PMVs) demonstrate high host plasticity (i.e., are able to infect a diverse range of hosts) and can cause significant morbidity and mortality in humans if cross-species transmission occurs. However, the diversity of viruses circulating in bats remains poorly understood, impeding our ability to prepare for and mitigate future disease outbreaks. As part of a joint collaboration between scientists at the Pathogen and Microbiome Institute and Bat Conservation International, bat oral swabs and fecal samples are being collected throughout the United States. We aim to (1) determine which whole genome sequencing approach (e.g., amplicon sequencing, hybridization capture) will be most efficient for generating whole CoV and PMV genome sequences from these samples and (2) use these whole genomes to conduct phylogenetic analyses. This will allow us to better understand the diversity and evolutionary history of CoVs and PMVs circulating in North America, as well as patterns of transmission within and among bat populations. Improving our knowledge of the bat virosphere and the evolutionary relationships within it may allow for earlier detection of and response to future spillover events from bat-borne viruses.	Jason Ladner	Biological Sciences

Karli VanderMeersch	Dismantling Us vs Them: The Relationship Between Multiethnic-Identity and Social Identity Complexity	In the United States, the population of multiethnic individuals, those identifying as two or more ethnic groups, increased by 276% from 2010 to 2020 (Marks et al., 2021). Despite the U.S. becoming more ethnically diverse, multiethnic-identifying people continue to experience overt and subtle forms of racism (Greig, 2012). Growing up in multiethnic households can result in individuals feeling "stuck in-between" their various cultural identities (Gaither, 2015). Social identity complexity refers to an individual's representation of the interrelationships among their multiple group identities and reflects the degree that overlap is perceived to exist between the cultural groups one identifies with (Knifesend & Juvonen, 2014). When the overlap of multiple "in-groups" is perceived to be high, the individual is likely to form one "in-group" identification encompassing everyone within that group. If there is little perceived overlap within their in-group, their social identity complexity lowers. Limited social identity complexity can result in a heightened in-group vs. out-group mentality (Knifesend & Juvonen, 2014). The purpose of the proposed study is to investigate how multiethnic-identifying students view their identities in the context of their college experiences. We will conduct focus groups, consisting of multiethnic-identified students to explore their lived experiences. Via analysis of the focus groups' responses, we expect to identify specific strategies that successfully produce and maintain diversified identities within organizations, with the goal of informing future student-serving initiatives on campus.	Eylin Marie Palamaro-Munsell	Psychological Sciences
Daisy Vega Monarrez	Investigating the Effects of Fiber-rich Diet on Pediatric Asthma and Gut Microbiome: A Molecular Analysis of TH2 Cell-Mediated Inflammation	This grant proposal aims to investigate the potential therapeutic effects of soluble corn fiber on pediatric asthma and further our understanding of the molecular mechanisms underlying its impact. Asthma is a chronic airway inflammatory disease affecting 300 million people worldwide and is the most prevalent chronic disease among children. The gut microbiome communicates bi-directionally with the lungs via the gut-lung axis, shaping immune responses and respiratory diseases, including pediatric asthma. Cytokines are signaling molecules that mediate cellular communication and immune responses in the body. Cytokines such as IL-4, IL-5, and IL-13 are part of the pathologic TH-2 immune response and have a significant role in the pathogenesis and progression of pediatric asthma.The primary hypothesis driving this grant proposal is that the administration of soluble corn fiber to pediatric asthmatic participants will lead to a significant decrease in the expression of IL-4, IL-5, and IL13 in the post-trial nasal lavage samples, as compared to the placebo group, indicating reduced airway inflammation. In pediatric asthma, IL-4, IL-5, and IL-13 are considered pro-inflammatory cytokines. Nasal lavage samples have been collected from 20 children who were randomly assigned to receive either soluble corn fiber or a placebo for 4 weeks. Samples will be analyzed using Enzyme-linked Immunosorbent Assay (ELISA) to test for the presence and levels of IL-4, IL-5, and IL-13 cytokines. The expected outcome of this study is to generate comprehensive data and visualizations that will advance our understanding of the molecular mechanisms underlying TH-2 inflammation in pediatric asthma.	Emily Cope	Biological Sciences

Catherine Young	The Efficacy of Using Rhizome Cuttings as a Means of Propagation for the Endemic Alpine Species *Packera franciscana*	This study will to determine if the critically endangered plant species Packera franciscana can be propagated by the cutting of its rhizome. The single mountain endemic species grows only in the alpine talus habitat in the San Francisco Peaks, north of Flagstaff, Arizona. The separation of the rhizome, a form of asexual reproduction, will mimic rhizome fragmentation, the dominant method of reproduction in the wild. I must acquire an Endangered Species Act Recovery Permit from the US Fish and Wildlife Service, my partner for this study. After harvesting seeds, I will germinate seedlings and establish a treatment and control group of plants. Several months later, I will separate a ramet from each mother plant in the treatment group with a sterilized blade. The control group, plants will not have any rhizome cutting. The mother and daughter plants will be potted separately. The control group will show that if it is healthy and the treatment group's propagation fails, it will likely not be due to a human mistake or disease since the control group does not show any signs of distress. Pictures and measurements of the plants immediately after cutting the rhizome will be compared to those one month after repotting. The control group will undergo the same threatments as the treatment group, only without cutting their rhizomes. I will consider propagation successful if measurable growth has taken place and the plant is healthy. Disease, deterioration, or decay will signify the failure of propagation. My study will provide new information regarding asexual propagation of *P. franciscana* that could provide a cost effective, practical method to quickly multiply the captive population while still preserving the essential characteristics of the species. As this plant may be at high risk for extinction, a way to efficiently increase their numbers could be critical to its survival.	Margaret Moore/ Shaula Hedwall	School of Forestry