HURA and Urdea Recipients 2021-2022

Student	Project Title	Abstract	Faculty Mentor	Faculty Department
Rebecca Ballard	Genomic reconstruction of transmission events of a large pneumonic plague outbreak that occurred in 2017 in urban centers of Madagascar	The bacterium Yersinia pestis (Yp), which causes plague, is ecologically established in locations around the world with Madagascar reporting the highest number of human cases. Plague is a rapidly progressing fatal disease that comes in two primary forms: bubonic plague (BP) and pneumonic (PP). BP is predominant and is acquired through a flea bite and if not rapidly treated with antibiotics, can progress to PP. Although PP is less frequent, it is more feared because it is socially contagious and rapidly lethal. Most global plague cases are BP but PP periodically erupts. In 2017, a large outbreak of PP (>1,800 suspected cases) spread through the two largest urban areas of Madagascar, a nightmare scenario for public health organizations like WHO. Little Yp DNA is available to reconstruct the transmission events of this outbreak except those found in the sputum of plague positive human cases. This source of Yp DNA is challenging and requires sophisticated molecular strategies referred as “bait-capture” to be able to perform genetic analysis. A large focus of my research proposal will be dedicated to employing these strategies to capture Yp DNA from human sputum samples. The ultimate objective is to analyze Yp genetic data from 2017 human sputum samples to reconstruct the transmission events of the 2017 outbreak. From our analysis, we can gain insights into whether the outbreak was facilitated by a single transmission source or multiple. This investigation will provide insights into PP dynamics that may be informative for devising countermeasures to mitigate future PP outbreaks.	Dawn Birdsell	Biological Sciences, Pathogen and Microbiome Institute
Jason Beller	Investigation of the Houck Sites in Pursuit of Finding Taphonomic Evidence of Burning	The purpose of this research is to determine if there are any taphonomic effects, specifically burn marks, present on any animal bones (elements) found at the Houck sites. Comparing the burn effects that may be present on the elements at the Houck sites to burn marks produced through experimental research can shed light on what human behaviors produce certain burn marks. Faunal analysis of the Houck sites will be conducted by NAUDAFAL volunteers using standardized data collection methods. This standard analysis includes identification of each element, species, and taphonomic effects present. Following this analysis, experimental research will be conducted by producing my own burn marks on different skeletal elements to mimic the ones found at the Houck sites. I expect to find similarities between the elements at the Houck sites and the elements that I have worked with. Comparing both sets of burns marks will help enhance experimental protocols that examine past human behaviors. After the experimental analysis produces similar effects as those found at the Houck sites, this experiment can be used to be a credible interpretation of past human behavior.	Chrissina Burke	Anthropology
Sofia Benitez	Exploration of human perception towards interior physical factors for enhancing social interaction: A study using Virtual Reality (VR)	Many researchers have addressed the importance of the community to the human social, emotional, and cognitive experiences (Waxman 2006; Oldenburg 1999; Warrdono 2012). Socializing in a space affects the lives of people positively by creating a sense of community, belonging, and attachment. Thus, environmental psychologists and interior designers have proposed social and physical factors to enhance social interaction in gathering places. Especially, the need to enhance social interaction is important for interior design due to the psychological factors that are considered when selecting interior materials, colors, or selecting finishes. However, it does not indicate detailed applications such as what degree and/or level of interior physical factors could have an influence on social interactions. Additionally, present studies have explored participants’ perceptions on 2D images of proposed spaces for data collection which is less credible than 3D virtual experiences. In this study, participants will be exposed to 3D virtual coffee shops and their emotional responses to the proposed physical settings will be measured.	Kyoungmee Byun	School of Art

Breezy Brock	Rabies Prevention with Early Intervention: A One Health Collaboration for Detecting Rabies Hotspots in Arizona	Rabies (RABV) is a zoonotic viral disease of mammals that causes a 100% lethal form of encephalitis. Despite RABVs ability to infect all mammals, it typically stays within one species reservoir. However, RABV continues to establish itself in new hosts (host-shifts), threatening the lives of humans and animals. The RABV transmission cycle within Arizona is poorly understood due to the success in reducing RABV transmissions to humans. However, there was a high number of rabies cases in 2020 leading to human exposures in highly populated areas. The overarching goal of this study is to optimize amplification sequencing to better understand how RABV is moving within and across wildlife reservoirs and geological spaces and identify species-specific hotspots within Arizona. We hypothesize that cross-species transmissions of RABV occur throughout Arizona which will lead us to RABV species-specific hotspots causing wildlife outbreaks in certain geographical locations. Identifying these locations would help public health officials develop new strategies for the implementation of a species-specific oral vaccination programs that could break RABV transmission chains among wildlife reservoirs and prevent human exposures.	Crystal Hepp	SICCS and Pathogen and Microbiome Institute
Frank Burkhart Alexander Stewart	Enumeration of signed permutations by reversal distance with applications to genome rearrangements	Differences between the genomes of two related species are the result of sequences of point mutations, in which a single nucleotide is modified, and genome rearrangements, where clusters of genes are modified. Continued genome rearrangements cause the order of the genes on a chromosome to become more and more scrambled over time. The genetic distance between two closely-related species is the minimum number of rearrangements necessary to transform one genome into the other. One of the most common types of rearrangements is called a reversal (or inversion), which swaps the order and orientation of a consecutive subsequence of genes along a chromosome. Comparing two similar sequences of genes yields two signed permutations. Each number in the signed permutation represents a single gene and the sign of the number indicates the orientation of the gene. The reversal distance between two signed permutations is the minimum number of reversals necessary to transform one permutation into the other. Since reversals typically make up the bulk of genome rearrangements, genetic distance can be approximated by computing the reversal distance between the corresponding permutations. Our goal is to expand the current knowledge of the structure of signed permutations and their relationship to each other via sequences of reversals. Each of the problems that we aim to tackle are of interest to mathematicians that study combinatorics and to computer scientists that study sorting algorithms. Any results that we obtain can be translated into statements about genome rearrangements, which have implications in the field of genetics.	Dana Ernst	Mathematics and Statistics
Amanda Fitzhugh	Douglas-Fir Hybridization Drought, Growth, and Phenology Study	Climate change is a problem for many species across the globe. Temperature and precipitation changes are predicted to effect ranges of many species, including Douglas-fir. Douglas fir is a very important species and as such efforts to understand and also to help protect Douglas-fir are needed. There are two different varieties of Douglas-fir: Coastal Douglas-fir (*Pseudotsuga menziesii var. menziesii*) and Rocky Mountain Douglas-fir *Pseudotsuga menziesii var. glauca*). These two varieties have some key differences such as differences in height, growing rate, and cold and drought hardiness. The two varieties hybridize naturally but few studies have been done on the resulting hybrids. This project will conduct a drought experiment to determine the hybrid's drought tolerance, measure growth through photosynthetic rate and number of stomata, and also record the bud burst and bud set of the hybrid compared to the two varieties. This data will be compared to the two varieties and the resulting information will be presented at the AU Hooper & Urdea Poster Presentations & Reception and the NAU Undergraduate Symposium and also in a paper that will be published to a peer-reviewed journal. Through the presentation and journal publication the information can be shared and help assist migration plans for Douglas-fir in the face of climate change effects.	Amanda De La Torre	School of Forestry

David Flint	Linkages between Travertine Deposition and Algae Growth in Fossil Creek, Arizona	Created from the precipitation of carbonate minerals, the sedimentary rock travertine creates some of the most fascinating geology on earth. Thankfully, one of the world's largest travertine deposits is located right here in Arizona, Fossil Creek. A tributary of the Verde River, Fossil Creek attracts tens of thousands of visitors every year due to its unique combination of rare lithology and riparian ecosystem. Sadly, climate change has drastically impacted water resources causing many streams in the Southwest to lose their ability in supporting aquatic life. Currently, Fossil Creek provides a habitat for many species of flora and fauna, some of which are endangered. The purpose of this research is to determine if there is a feedback loop between travertine deposition and biotic life in fluvial systems. Determining a correlation between the deposition of travertine and the growth rate of aquatic life will promote further knowledge on ecosystems that are being drastically impacted by climate change. Moreover, I will measure the nutrient composition of travertine streams in comparison to non-travertine streams to determine if travertine produces better systems for the preservation of biotic life. This research will bring further awareness on abiotic and biotic relationships, while also providing data on preferred nutrient values of riparian species that can help mitigate the effects of climate change.	Jane Marks	Biology and ECOSS
Sophia Frohna	Predicting COVID with Wearables and Wastewater	Tracking cases of infection has been a crucial measure to protect human health and life in the era of the COVID-19 pandemic. As many regions and institutions begin the reopening process, often while still in the midst of high rates of infection, we look to various means of disease detection and surveillance to limit the potential spread, but many current methods of detection come with crucial shortfalls. Comprehensive individual testing with swabs can be prohibitively expensive for many institutions. The Fitbit, a widely used wearable device which tracks physiological data such as heart rate and activity, has been used in the past to predict cases of influenza and other illnesses. One other promising new method of detection is the sampling of wastewater from public sewers for the presence of SARS-CoV-2 RNA. Pairing these sources of data from participants living on-campus, I look to produce a machine learning model to predict cases of COVID-19.	Kyle Winfree	SICCS
Cedric Gammon	Impacts of reclaimed snowmaking on soil microbiota within the San Francisco Peaks	In the Southwestern United States, precipitation is low and highly variable. To combat unstable precipitation, businesses and municipalities have used reclaimed water to reduce consumption of natural water. One of these uses has been reclaimed snowmaking. Sampling from the Snowbowl Ski Resort on the San Francisco Peaks in Flagstaff, Arizona, I will quantify the effects of reclaimed snowmaking on forest ecosystems, emphasizing impacts on soil fauna and fungi. Reclaimed water has higher pH, salt, and nutrient (nitrogen and phosphorus) levels than natural water, and these differences may impact the structure and function of soil microbiota communities (nematodes, mycorrhizal fungi, and saprotrophic fungi). We expect soil microbiota diversity to decrease and soil microbiota abundance to change significantly. Understanding their response to this reclaimed water use will enable land managers to make informed decisions about snowmaking.	Anita Antoninka	School of Forestry
Jasmyn Genchev	Conjugation of Methamphetamine to Q-Beta Virus-Like Particles for Vaccines to Combat Addiction	For years, the Methamphetamine epidemic has been sweeping across the United States. Various factors have led individuals to become addicts which has the potential to lead to neurobiological disorders within the nervous system from long term exposure and in many cases caused lethal overdose. One solution for the crisis of this drug is developing a therapeutic vaccine using Q-beta virus-like particles, VLPs. In this project, I will be utilizing synthetic peptides that are modified with a Methamphetamine hapten. A successful synthesis of the Methamphetamine hapten has already been completed. In comparison, similar tests prepared using HPV antigen conjugated self-assembling fibrils showed a successful production of antibodies within the mice. Next steps for the Methamphetamine haptenpeptide vaccine candidate will include animal studies based off the success from HPV antigen-fibril trials. In continuation, similar conjugation procedures will be utilized to link haptens to self-assembling fibrils as immunogenic carriers rather than VLPs to determine if antibody responses change.	Naomi Lee	Chemistry and Biochemistry

Emily Godin	An Analysis of Climate Change Curriculum Implementation in Flagstaff Middle Schools	Data explicitly supports that Earth is facing a climate crisis, yet Arizona Science Standards severely underrepresent and suppress climate change causes, severity, and solutions. These vague standards leave interpretation open to individual districts, schools, and teachers. In analyzing Flagstaff public schools' application of Arizona Science Standards and delivery of climate change concepts, there is potential to reform curriculum and inspire other schools to do the same. This study's goal is to conclude what type of curricular implementation yields the deepest student understanding of climate change and how successful it is in preparing middle school students to solve the future climate crisis. Data will be collected in two Flagstaff middle schools through generalized and specialized classroom observations, teacher interviews, examination of curriculum differences, and student surveys. Classroom observations will focus on student interaction with the material, lesson engagement, and instructional delivery differences between the generalized and specialized classroom. Teacher opinion of observed lessons, students' learning goals, and the lessons' associated science standard will be gathered during interviews. Generalized and specialized program curriculum comparisons will yield any disparities in the standards each classroom addresses. The student survey will gather data on school workload, extracurricular activities, and curriculum to gauge the students' understanding of climate change given what they have been learning inside and outside of school.	Jo'el Johanson	Stem Education
Joseph Green	Understanding ExoEarths from Thermal Infrared Observations	It is currently unknown how difficult or how easy it is to identify the signatures of an Earthlike exoplanet from a spectrum. The information contained in a spectrum of an exoplanet can be understood through a process called atmospheric retrieval. Using an existing retrieval package, we will study infrared spectra of Earth under 18 different scenarios. The different parameters being changed in each retrieval represent different quality spectra. Simulating different quality spectra allows us to identify what quality spectra are required to it. Using simulated retrievals we hope to gain an understanding on what kind of instrument performance future missions would need to successfully characterize exo-Earths. Editing and testing the retrieval software, simulating and running the retrievals, and analysing the data from the retrievals will span the coming academic year, and will result in poster presentations and a publication.	Tyler Robinson	Astronomy and Planetary Science
Andrew Henning	Mistletoe and Pandora Moth Relationship to Resin Defense in Ponderosa Pines	The primary defense for ponderosa pines against parasites, pathogens, and herbivores is resin produced in resin ducts. My proposed research assesses whether resin ducts are altered by two ponderosa pine stressors, dwarf mistletoe and pandora moths. Mistletoe, a parasitic plant, causes mortality in highly infested trees and increases a pines susceptibility to bark beetles. The relationship of resin flow to mistletoe infestation has not been studied in ponderosa pine. Pandora moth caterpillars are another stressor creating needle loss of >90% during outbreaks. The caterpillar reduces tree growth and increases susceptibility to bark beetles. My study examines two questions; (1) Does mistletoe negatively affect ponderosa pine resin duct production and is this the primary cause of reduced resin flow and composition changes in trees with high mistletoe infestation? (2) Does defoliation by pandora moth outbreaks negatively affect ponderosa pine resin duct production, making these trees more susceptible to biotic agents of mortality? I will take cores from ponderosa pines to examine the effects different levels of mistletoe and pandora moth infestation has on resin ducts. Resin samples will be taken using resin taps to measure flow rates and differences in chemical composition. I hypothesize that a tree's resin defenses are inversely related to mistletoe and pandora moth severity levels. I anticipate that the growth-defense patterns will potentially be different due to infection dynamics. This information will be valuable for land managers to better understand factors that affect ponderosa pine survival in Arizona and predict tree mortality.	Richard Hofstetter	School of Forestry

Elliot Hoy	Increasing the Awareness of Geology In Arizona One Step at a Time	Geology is the scientific study of the origin, history and structure of the earth. The study of it is critical in order for us to understand and relate to our planet. Geology is more than the study of rocks and the subsurface of the Earth. Geology explores earths mountains, valleys, rivers, coasts, and so much more, and how all of this impact the environment and society. Unfortunately, just as our need for more geologists is growing, fewer and fewer students at Northern Arizona University (NAU) are choosing Geology as their major, even though Geology leads to some of the most fulfilling career opportunities and pays among the highest in STEM professions. This proposal focuses on encouraging the study of Geology by engaging K-9 students in eco-friendly tours that will motivate them to care about, and ultimately study, our Earth. These eco tours will be self guided, fun educational tours around the local area and will highlight our dependence on and connection with the earth. These tours will introduce children not only to our local eco system, but also to what geology is, and how the study of geology can greatly impact our world.	Paul Umhoefer	Earth and Sustainability
Dakotah Huffman	How Nature can Heal: An Exploration into the Relationship between Affect and Exposure to Nature During a Pandemic	With the dawn of the Information Age, humans have become increasingly disconnected from nature and increasingly connected to artificial man-made technological environments. The increased stressors from the recent COVID-19 pandemic have intensified our reliance on technology to continue school, work, and to socialize with others, and thus, contributed to exacerbating effects of the mental health crisis our society finds itself in. These factors are especially relevant to young adults, which is the demographic this project will focus on. This research will investigate the connection between nature and its impact on individuals' emotional wellbeing and affect, which can be exhibited by people's emotions, feelings, and moods. The project will answer the following questions: What is the relationship between one's affect and exposure to nature? Can the solitary element of time spent in nature be an effective coping mechanism for individuals in times of stress, regardless of the activities the individual is participating in outdoors? How do various individuals perceive their own internal process of their experiences in nature? These questions will be examined via a mixed-methods approach, including both qualitative and quantitative research methodologies. Participant observation and interviews will be employed to acquire rich insight from participants of diverse backgrounds and life experiences. Additionally, quantitative research will be aggregated from the questionnaires participants will have the opportunity to complete. An extensive literature review will provide the foundation to this project in order to add new insights into the connection between people, nature, and affect in times of increased stress.	Natasa Garic-Humphrey	Anthropology
Christian Jarish	Pyroclastic Dune Formation of the Haskie and Triplets Maars	The Haskie and Triplets maars in the Hopi Buttes volcanic field produce deposits that contain dune formations following an explosive eruption. These dune formations resemble sedimentary dunes; however, they are different in size and have fine layers called laminae across both sides of the dune. This suggests dunes created in volcanic deposits are formed by different processes than those in sedimentary deposits. It is currently unknown how these unique dunes are formed. Laminae within volcanic dunes contain magnetic minerals that are emplaced in a specific way due to the grains induced magnetism. After traveling to the field to collect samples from volcanic dunes, the orientation of induced magnetism in the laminae grains is measured using magnetic susceptibility meters. The PI and faculty mentor hypothesize that analysis of oriented samples can determine how dunes are formed in volcanic deposits and if laminae development is indicative of their formation process.	Michael Ort	Earth and Sustainability

Sidney Laham	Ponderosa Pine Dwarf Mistletoe Responses in the Midst of a Prolonged Drought	Ponderosa pine (*Pinus ponderosa*) dwarf mistletoe (*Arceuthobium vaginatum subsp. cryptopodum*) has been present in the southwestern region for centuries. Until recently, this pathogen has been seen as a threat to forest health. The Ecological Restoration Institute (ERI) has established plots on the Mogollon Rim in northern Arizona (Mogollon Long-term Ecological Assessment and Restoration Network (LEARN) study site). In 2014/2015, ERI completed a field evaluation on the presence/absence and amount of dwarf mistletoe in ponderosa pine on 270 plots at the Mogollon LEARN study sites. For this project, I will revisit a subset of plots including re-measuring all previously infected plots where dwarf mistletoe was previously surveyed, and I will examine the spread of dwarf mistletoe over the past six to seven years. I will examine how slope, tree density, and long-term drought conditions affect the presence/absence and spread of dwarf mistletoe in ponderosa pine along a precipitation gradient, and document the vulnerability of these trees to pathogens and future changes with climate.	Tzeidle Wasserman	Ecological Restoration Institute
Lovenia Libby	Software Development for Investigation of Eutectic Phase Behavior on Pluto and Beyond	A eutectic system is a chemical mixture that freezes at a temperature lower than the melting points of its constituents. Solutions with unique eutectic properties are valuable to many material science applications and function in many natural phenomena. We hypothesize that one such phenomenon is present on the surface of Pluto, whose surface morphology suggests the motion of liquid on its surface at temperatures far below the freezing point of known substances. By developing a framework for comprehensive and detailed computational analysis of eutectic behavior, we will better understand the composition of Pluto and solar system bodies with similarly puzzling morphology, as well as the molecular mechanisms responsible for the effect these chemicals have on one another. We will inspect these effects by using molecular dynamics simulations to predict the motion of molecules in a closed system over time according to Newton's laws of motion. By comparing the behavior of the pure components to their behavior in mixtures, we can quantify how the molecules affect each other by investigating a variety of features such as density and potential energy. This will allow for a detailed understanding of molecular mechanics that could not be measured as easily in an experimental setting. This will also greatly reduce the time and costs of studying these systems by screening them for relevance before beginning experiments. The automation of the simulation and analysis processes will provide a resource for efficient and reproducible study of similar systems for future researchers.	Gerrick Lindberg	Applied Physics and Materials Science
Katherine Martin	Supporting Female Students and Teachers in Refugee Classrooms	The lack of access to quality education for thousands of refugee girls is one of the biggest concerns for refugees. As of 2019, the United Nations High Commissioner for Refugees (UNHCR) identified only 27% of all refugee children enrolled in school as female ("Her Turn…"). Among the barriers that girls face, one involves a lack of female teachers in the classroom and I suggested that this gender gap could contribute to girls' low rates of school; if more female teachers were present, they would serve as a role model, make girls feel safer within their environment, and help break down the social-cultural barriers for women and girls. While this topic in refugee education has not been heavily researched, the goal of this project is to identify the validity of this claim and find whether increasing the number of and supporting female teachers is feasible. This research project will include a literature review identifying important sources from 2011 when the refugee crisis started being documented, to now. This project will also include interviews with women's groups and refugee groups in the US to discuss their schooling experiences in their home countries and how they feel they can be best supported.	Frances Julia Riemer	Educational Foundations

Tobias Mayfield	Geomorphic threshold and water table level influence on arroyo incision in Southeastern Utah	The causes of arroyo incision within arid environments have been debated within the geologic community for years. The current general consensus is that incision is climatically driven. While climate plays a major role in the incision process, there is another factor which greatly influences an arroyo's ability to cut into and fill with alluvium - the relationship between an arroyo's geomorphic threshold, which is a threshold of landform stability, and the level of the water table within the valley-filling sediment. As an arroyo fills with sediment and the water table fills the volume within the sediment, eventually a threshold is reached. Once reached, any change in the environment like a drought, or a slight drop in the water table can make the channel susceptible to incision. This could explain why neighboring valleys in the arid Southwestern U.S. have recorded asynchronous arroyo-cutting events. I will test this hypothesis using a Ground Penetrating Radar (GPR) to measure the depth of the alluvium within two incised valleys in Southern Utah. I will also collect sediment samples to measure their porosity to estimate groundwater storage volume. I will send alluvium samples to Utah State University's Optically Stimulated Luminescence lab to date the quartz crystals within the arroyo and determine the last time they were exposed to sunlight. This is important as the date can then be correlated to the last time the sediment was deposited. The data collected will test if the fill volume of an arroyo directly influences the channels vulnerability to incise.	Taylor Joyal	Earth and Sustainability
Paetyn McCarter	Characterization of the bedded tuffs of San Joaquin Mountain, California	Subduction of the oceanic crust began in California 275 million years ago. From this subduction came volcanic systems that produced deposits of volcanic rock in the High Sierra countryside, near the Mammoth Lakes area. These volcanic rocks are Triassic in age and hypothesized to have come from a massive caldera. The purpose of this research is to determine if all of the ignimbrites in the field area can be linked to the same volcanic process at the same time, or whether they are not related at all. If they are not related, this research will determine where the bedded tuffs of San Joaquin Mountain came from. To determine this, geologic mapping and analysis of mineralogical composition will be used. This research will help to understand the evolution of a subduction zone.	Nancy Riggs	Earth and Sustainability
Tiffany McCremens	Analyzing the Potential Implications of Ride-hailing Adoption within Marginalized Communities in a Post-Pandemic Society	Over the past decade, emergent mobility services such as ride-hailing (e.g., Uber and Lyft) have quickly shifted individual perceptions and behaviors regarding modern transportation. The ongoing COVID-19 pandemic has presented significant challenges to ride-hailing platforms and to their users, some of whom depend on these services as a primary means of transportation. Marginalized communities, who often have limited economic means and less access to quality mobility options, have also been disproportionately affected by the pandemic. However, since the start of 2021, the distribution of vaccines and the continuation of standard health protocols have proven to mitigate the virus. As society progresses towards pre-pandemic normalcy, this project will investigate the potential transportation implications that marginalized communities have endured from reduced ride-hailing service availability as well as the temporary halt in the cost-effective pooling option. Thus, analyzing how individual perceptions regarding the resumption of these services have changed during the pandemic and how these implications will perpetuate in the immediate future.	Steven Gehrke	Geography, Planning, and Recreation

Gwen Metcalf Elliana Bastian	Impact assessment of Colorado River contaminants through the use of the rainbow trout (Oncorhynchus mykiss)	The Colorado River is a vital water resource for the basin states, providing for agriculture, drinking water, and energy for Americans in the Southwest United States. This includes many federally recognized Native American tribes. The presence of mining and agriculture industries has introduced contamination to the basin water systems. This project hopes to use inductively coupled plasma mass spectrometry and cold vapor atomic absorption spectroscopy; techniques used to quantify metal contaminants. As well as, ion chromatography mass spectrometry, a technique used to quantify perchlorate levels, which will provide information on environmental sample contamination. Completion of the project will provide greater understanding of the extent of Colorado River contaminates, and the influence of metal(loid)s as well as organic and inorganic pesticides on the ecosystem. Behavioral data from rainbow trout raised in Colorado River basin water will demonstrate the effects of contamination on fish behavior and survivability. This research will also demonstrate the utility of rainbow trout as an ecosystem health model for the Colorado River basin. The results and outcomes of this study will be presented back to the community and university contributors to broaden the knowledge of model organisms and Colorado river contamination.	Jani Ingram	Chemistry and Biochemistry
Dustin Mullaney	Functionalization of MS2 VLPs to Develop a Novel HPV Vaccine Platform	Worldwide, persistent high risk Human Papilloma Virus (HrHPV) infections result in 500,000 cancer incidences annually, mostly cervical. Though there is an HPV vaccine, it does not provide protection for all HrHPVs. Some of these HrHPVs are shown to be highly prevalent, particularly in Native American communities (Winer), and Native American women appear to be disproportionately affected by HPV (Schmidt-Grimminger, et al.). HPV vaccines are based on self-assembling virus like particles (VLPs), which are produced by bacterial expression and are highly immunogenic. Current HPV vaccines are based on the L1 HPV capsid protein, however a vaccine displaying more than this single antigen could produce a robust immune response which offers better protection. MS2 VLPs are easily produced and amenable to genetic modification to display various antigens. This project will focus on the conjugation of synthetic oligo-nucleotide adjuvants to L2 antigen displaying MS2 VLPs. This novel vaccine platform could broaden the coverage of current HPV vaccines to better protect Native American communities.	Naomi Lee	Chemistry and Biochemistry
Ezekiel Ocallaghan	Ephemeral Mammal Trackways in Pyroclastic Deposits	Volcanic deposits in the Verde Valley contain fossil trackways from mammals. Trackways are only rarely found in volcanic settings, making these fossils unique in their preservation. The deposits are believed to be a part of the Towel Creek Tuff. This is a soft rock unit, which is rapidly eroding near the Verde River. Most significantly the tracks themselves are eroding before documentation. This project will document the known fossil bearing site, investigate other outcrops for fossils by correlating the site to other areas, and create a plan for preservation and further documentation of the site. Mapping tools will be used to create multiple maps of the site through time to observe the changes which occur at the site over time. This will require many trips to the site for observation. Additionally, thin sections will be used to correlate the site with other similar outcrops of tuff within a few kilometers of the site. These tools will allow for accurate recording of the fossils in the tuff so that if they do erode there is still a record of them to be used in other research. Based on erosion rates found from these tools a plan for future visitation and documentation of the site.	Linda Lassiter	Biological Sciences

Zane Ondovcik	The effects of temperature on different detection methods for Ambystoma tigrinum virus (ATV)	Ambystoma tigrinum virus (ATV) is a viral pathogen that causes significant summer epidemics in Arizona tiger salamanders (Ambystoma tigrinum). Current methods of detection include eDNA confirmation through the swabbing of individual salamanders and collection of water samples from sites. Previous work has shown that temperature plays a clear role in host-virus interactions between ATV and tiger salamanders, affecting the virulen ce, mortality rate, and viral shedding of ATV. Our goal is to test current methods of detection under different climatic conditions to determine their accuracy at different stages of an epidemic. We will analyze previously collected data to investigate correlations between temperature and ATV detection accuracy. We will then collect additional data from more field sites to support the findings of our preliminary data analysis. We predict that water filtration will outperform swabbing early in the epidemic season, when temperatures are cooler, viral particles persist longer, and finding an infected host is rare.	Joseph Mihaljevic	SICCS
James Patton	Geological Investigation of a Newly Uncovered Normal Fault Along Highway 180	However, at higher temperatures, we anticipate the converse -- swabbing will perform as a better indicator through point-source detection, where otherwise filtering may be inhibited by viral overload in the environment, overestimating the magnitude of an epidemic. This project aims to establish best-use and efficiency standards in future research regarding ATV in Arizona tiger salamander habitats. We plan to disseminate our findings through poster showcases and presentations to local Northern Arizona high schools to promote STEM careers in conservation and research.	Nancy Riggs	Earth and Sustainability
Maren Porter	Standardized Approach for Measuring Esophageal Pressure in Humans	In the field of respiratory physiology, an important area of study is "mechanics of breathing." The study of mechanics aims to gain a better understanding of the interrelationships between air movement and pressures generated by the breathing muscles. The most common method of measuring this is by measuring pressure in the esophagus (tube food travels down) using a "balloon-tipped catheter." Placement is done by passing the catheter through the nose and having the participant swallow it so it ultimately rests in the lower third of the esophagus. Placement of the balloon to the correct location is critically important for precise, accurate data, but there are a variety of methods for determining what location should be used. The "gold standard" method is the "occlusion test," which is time-consuming and requires the participant to perform several breathing efforts in order to identify the most precise location. Other methods are more timely and less complex, but either do not account for height or rely only on seeing a particular pressure deflection during breathing. The accuracy of these other methods to produce the correct depth and precise, accurate data has not been studied. In this study, we propose to study individuals with balloon-catheters placed and location determined via three different methods. We will compare and contrast data during 2 periods: resting breathing, exercise breathing, and will measure pulmonary system compliance (measurement of ease of expansion). Using the "occlusion test" as the gold standard, we will determine how data collected via the other placement methods compare.	JJ Duke	Biological Sciences
Griffin Riley	Mobility of Heavy Metals from the Mine Tailings of Jerome, Arizona	In large amounts, heavy metals are dangerous to all lifeforms. The abandonment of mine tailings allows heavy metals to leach and erode out of their host rocks and move across landscapes. In Jerome, Arizona, mine tailings have sat still since the first half of the 20th century, exposing the heavy metals to erosion and weathering processes which allow movement of the heavy metals away from the mine tailings and down in elevation. These now mobile heavy metals could cause harm to the ecosystems of Central Arizona and the Verde Valley. This project will assess the full extent of metal mobility from the United Verde Mine tailings. I will do this by taking soil and groundwater samples and testing them using an inductively coupled plasma mass spectrometer to analyze the concentrations of copper, zinc, and lead. The data collected will be organized into a map with a concentration gradient of the metals. This project is important as it will determine if reclamation needs to occur on the United Verde Mine tailings.	Laura Wasylenki	Earth & Sustainability and Chemistry & Biochemistry

Revecca Rioux	One hundred years of plant composition and cover changes at three rangeland sites in northern Arizona.	The focus of this study is to examine plant species composition and plant cover changes over the past 100-years at three rangeland sites in northern Arizona (AZ). These sites, located near Seligman, Williams, and Tusayan AZ, were established in 1918 to measure the impact of livestock and rodent grazing. Plant composition and cover were mapped on permanent quadrats located inside and outside livestock grazing exclosures. I will remap the plant composition and cover on a subset of these historical quadrats to determine the change in species and cover over this 100-year period. My results will inform range managers and restoration ecologists on the long-term impact of livestock grazing on the native grasses, forbs (wildflowers), and shrubs in these areas.	Margaret Moore	School of Forestry
Bethany Robinson	How Disability Status Affects Incarcerated Female's Recreational Time Attendance and Utilization at a Rural Jail	Jails are not designed with female physical tendencies in mind, primarily exemplified through the lack of consideration regarding their exercise. Female exercise often consists of cardio, yoga, and light weights. Incarcerated females face many limitations during their recreational time that restrict their physical activity levels. Recreational areas in jails are often outside and consist of a cement floor, a bodyweight training station, and an inadequate amount of room to run. Although exercise for those with disabilities can already be rather challenging, incarcerated individuals with disabilities may face additional barriers. With insufficient accommodations or assistance, it can be nearly impossible for someone with a disability to be physically active while in jail. Through a survey of incarcerated females at the Coconino County Jail, I plan to discover how disability status affects female attendance and utilization of recreational resources. The survey results will provide a better understanding of the barriers females with disabilities face regarding recreational time. My goal is to share the survey findings with the jail staff and administrators of the Coconino County Jail and have an open discussion on ways to better assist incarcerated females with disabilities in becoming more physically active.	Ricky Camplain	Health Sciences
Letty Rodriguez	A Comparison of Subduction Zones of the Japan Margin and the Alaska Margin	The Japan and Nankai trenches are subduction zones off the coast of Japan that have hosted high magnitude earthquakes and tsunamis. In both trenches, researchers have been mapping faults, investigating their role in producing large marine earthquakes, and damaging tsunamis. The Alaska margin is a subduction zone, located along the Aleutian Islands in Alaska that is capable of hosting large earthquakes. In this research project I will be comparing the structural geology of the Alaska margin to the Japan and Nankai trenches, using similar mapping and analysis methods, to better understand if a large magnitude earthquake and tsunami is possible in this area. I will be studying and mapping faults in the Alaska margin using methods developed by an NAU PhD student to prepare the elevation model for analysis and generate and analyze the basins of the trench. I will also map the faults where I expect to find the west portion of the Alaska margin to have fault-bounded basin topography similar to the Japan Trench. I then expect the eastern portion of the Alaska margin to not have fault-bounded basin topography, but have imbricate thrust faults on the upper plate similar to Nankai trench. Presenting this research will demonstrate to other students that undergraduate research is possible with the support of their university. This mapping will also allow me to gain research experience and inform others of the potential for high magnitude earthquakes and large tsunamis in the Alaska margin.	Christine Regalla	Earth and Sustainability

Maria Salazar	Impacts of increasing water temperatures due to climate change on the reproduction rates of the invasive P. Canaliculata	Pomacea canaliculata, commonly referred to as apple snails, are an aquatic invasive species that have spread to many different countries throughout the world and are affecting aquatic biodiversity. One of the main attributes of their invasiveness is their high reproduction rates, P. canaliculata reproduce year-round and are sexually mature when the snail reaches 2.5 cm in diameter, which takes about 45-59 days. Their rapid reproduction rates allow population sizes to grow, especially if they enter an area lacking natural predators/areas with low rates of predation. P. canaliculata are known to be active at warmer temperatures, and with the increase in water temperatures that is predicted to occur over the next few decades due to climate change (0.72°C per decade), I hypothesize that if the water temperatures increases as predicted, then the reproduction rates for P. canaliculata will also increase. I propose to test this hypothesis by observing the reproduction rates of these apple snails at projected future temperatures. A group of egg masses will be collected from the lower Salt River and then fecundity, egg mass size, and egg mass viability will be observed at current water temperatures (20°C), at water temperature predict for four decades from now (22.9°C) and at water temperatures predicted for eight decades from now (25.7°C).	John Weser	Biology
Zachary Taylor, Abigail Parker	Assessing Gender Biases in Future Managers: An Examination of Perceived Family-Work Conflict	One workplace structure that recent research suggests will remain after the pandemic is working from home. While this brings about certain benefits, such as flexibility, it can have consequences: higher family-to-work conflict (FWC). In the context of these developments, it is important to consider the role that FWC plays in the workplace, especially in terms of gender biases. This study builds off of previous research that found that managers perceived their female employees to experience more FWC than their male colleagues, regardless of a lack of research supporting this idea. We use social role theory to examine factors that may be associated with sex that may influence this perception, such as societal ideas of women having primary caretaking responsibilities. This can lead managers to perceiving women as having limited resources to devote to work. Our study will examine these biases in a sample of business students, who will be society's future managers. We hypothesize that women with children will be rated as experiencing more FWC. We also hypothesize that women working in a traditionally masculine field (e.g. STEM), will also be rated as having higher levels of FWC. To test these hypotheses, we will conduct a vignette study where we create short descriptions that are all the same except for key variables, sex, field of work, and presence of children and then ask participants to rate important outcomes (FWC, promotability, performance). A three-way ANOVA will be used to analyze results.	Ann Huffman	Psychological Science
Ellaine Villano	Measuring global protein thiol oxidation status with maleimide infrared dye labeling	One workplace structure that recent research suggests will remain after the pandemic is working from home. While this brings about certain benefits, such as flexibility, it can have consequences: higher family-to-work conflict (FWC). In the context of these developments, it is important to consider the role that FWC plays in the workplace, especially in terms of gender biases. This study builds off of previous research that found that managers perceived their female employees to experience more FWC than their male colleagues, regardless of a lack of research supporting this idea. We use social role theory to examine factors that may be associated with sex that may influence this perception, such as societal ideas of women having primary caretaking responsibilities. This can lead managers to perceiving women as having limited resources to devote to work. Our study will examine these biases in a sample of business students, who will be society's future managers. We hypothesize that women with children will be rated as experiencing more FWC. We also hypothesize that women working in a traditionally masculine field (e.g. STEM), will also be rated as having higher levels of FWC. To test these hypotheses, we will conduct a vignette study where we create short descriptions that are all the same except for key variables, sex, field of work, and presence of children and then ask participants to rate important outcomes (FWC, promotability, performance). A three-way ANOVA will be used to analyze results.	Tinna Traustadottir	Biological Sciences

Bryce Fennell Steven Schwartz Brennen Transier	Portable UV-C Sterilizer for High Traffic Surfaces Susceptible to COVID-19 and Other Infectious Agents	Due to the COVID-19 pandemic, many retailers are attempting to sterilize contact points for the safety of those who are using them; however, many of these machines are sensitive electronics and are highly susceptible to damage from traditional liquid disinfectants and are expensive to replace. COVID-19 has shown the ability for pathogens to be transmitted quickly and the need for quick cleaning methods has arisen. Often, when cleaning electronic products, the harsh chemicals in cleaning agents such as bleach and chlorine can negatively impact the electronics being cleaned due to their liquid and corrosive nature. Additionally, the cleaning process on electronics is lengthy and time consuming leading to long lines and slower service (30-90 seconds). UV-C lighting does not pose the same risk to sensitive electronics cleaning agents do and can sterilize surfaces in significantly less time (15-30 seconds). This proposed project looks to foster a synergistic collaboration, by combining multidisciplinary student interests from the areas of biology and engineering research. Combining these efforts will result in one or more prototype designs created to sterilize regularly used surfaces and electronics with minimal or no damage. This project plan includes first testing optimal wavelength at a standard distance (20mm) and wattage (8 watts), next testing wattage at the optimal wavelength and at the standard distance (20mm), and finally testing the effective operating distance at the optimal wavelength and wattage. The NAU Urdea grant would provide funds to foster this research and provide undergraduates with design, implementation, and testing experience.	Timothy Becker	Mechanical Engineering
Kailey Lewis Brennen Transier Josette Vigil	3D-printing of biomaterials for a bench top blood vessel model	Stroke devices, delivered from inside the blood vessels (endovascular access), are used to treat a variety of aneurysms that can form in the human brain. It is estimated that between 3 million and 6 million Americans have cerebral aneurysms, of which 30,000 hemorrhage each year in the US alone.[1–4,6,10,12] While there have been notable advances in endovascular access to aneurysms, there is a need for high performing bench-top models that can simulate the human condition, reduce the need for animal studies, and reproduce the complexities of larger aneurysms that typically regrow (recanalize) after treatment (as high as 70% recanalization rates are common). This proposed project looks to foster a synergistic collaboration, by combining multidisciplinary student interests from the areas of biology and engineering research. Combining these efforts will result in benchtop vessel models that replicate complex aneurysms and mimic the mechanical properties of human vessels. This project plan includes simulating vessels and aneurysms with dimensions that more closely approximate human (in vivo) anatomy and physiology. Models will be created using newly-identified biomaterials and printed with NAU's Polyjet 3D-printer, located in the Bioengineering Devices Lab (BDL). The new benchtop models will be tested and used to assess the treatment effectiveness of a new line of aneurysm treatment devices. The NAU Urdea grant would provide funds to foster this research and provide undergraduates with design, implementation, and testing experience. This research is focused on reducing patient morbidity and mortality from aneurysms while providing undergraduate students with experience in innovative translational research opportunities.	Timothy Becker	Mechanical Engineering

Zacharia Bess Logan Schubert	Ionic Liquids Curing Agents	Amino Acids [AA] are used to cure epoxy resins, because of the active hydrogens and amino groups in the molecule to allow the cured resin to become a crosslinked polymer. Ionic Liquids can be used to introduce certain molecules into a system in the liquid phase, and cysteine and lysine are two amino acids that can be used to cure the epoxy precursor poly(ethylene glycol) diglycidyl ether (PEGDGE). Lysine is a diamine with two primary amine groups, and the cysteine has one primary amine group and a sulfhydryl group that can also react like an amine group. Lysine and cysteine will be the anions in ionic liquids that will then be applied to the epoxy resin in liquid state then applied to fully saturate electrodes. The type of electrolytes being created are GPEs and they will be made from the curing of PEGDGE by the amino acid ILs that allow them to be applied to the electrolyte system. These two amino acid curing agents will be tested to view the rheological, conductivity, and mechanical testing to view how the tri-branched and tetra-branched systems compare. The importance of this project is that it will provide a safer and more sustainable solid electrolyte that will be applied to capacitors that will be used in mechanical appliances. One appliance that this can be applied to are solar panels, which would help make a more green and sustainable energy source. This is also an opportunity to use ionic liquids and add to the growing knowledge of the functionalities and possible applications they can have. It is expected that this project will be done by the Spring semester of 2022, and the ionic liquids will be able to cure the electrolytes and form functional capacitors that will be used for various mechanical applications.	Cindy Browder	Mechanical Engineering