HURA Grant Recipients, 2018-2019

Student	Project Title	Abstract	Faculty Mentor	Faculty Department
2018-19 Projects				
Morgan Andrews	**Climate Stressors and the Tolerance of Freshwater Invertebrates Along an Elevational Gradient**	Aquatic invertebrates can act as ecological health indicators; habitats that support these species are increasingly vulnerable from climate change. I will use field studies and lab tests to grasp which invertebrates will best persist under climate stress. In the field, species will be surveyed in 20 ephemeral and permanent stock ponds on an elevation gradient. I will analyze invertebrate features of breathing mode and dispersal strategy. I expect to see warmer, lower elevations have more surface breathing species because of reduced dissolved oxygen. Second, I postulate that all ponds will have equal amounts of species, but ephemeral pools will have more surface breathers. Experimentally, I will separate temperature and oxygen stresses. I expect surface breathers will endure high temperatures better as they often face these burdens jointly, and may of evolved to endure both. Six species from low elevation ponds will be exposed to temperature baths with aeration, showing differences amid species impartial of oxygen. Surveying and testing invertebrates will give insight into how they tolerate stressors by dispersal, breathing styles, and evolved features.	Rebecca Best	SESES
Zachary Barrand	**Prevalence and Strain Diversity of Ixodes spp. Ticks coinfected with Borrelia spp. and Anaplasma phagocytophilum, two abundant zoonotic disease agents**	The purpose of the study is to analyze the prevalence and strain diversity of Borrelia burgdorferi sl and Anaplasma phagocytophilum coinfections in Ixodes spp. ticks. Tick-borne pathogens and diagnoses have increased in numbers from 1992 to 2014 in the west coast, midwest, and northeastern states (Eisen et al. 2017). Many factors have contributed to this increase including shifts in the distribution of ticks, human exposure to ticks and increased tick-borne disease awareness, and the presence of coinfected ticks. Ticks will be collected through a free citizen science program and are mailed to the testing facility, identified to species, and tested for pathogen presence using qPCR. Samples that are positive for both B. burgdorferi sl and A. phagocytophilum will then be sequenced. Sequence diversity and phylogenetic analysis will be used to determine a relationship between coinfections and single tick-borne infections. We hypothesize that there will be lower pathogen strain diversity within coinfected ticks than tick populations that have single infections.	Nathan Nieto	Biomedical Sciences
Hannah Beskind	**Do phytonutrients in broccoli enhance the exercise response in older adults?**	Exercise improves health through cell signaling that results in increased stress resilience. However, recent data from our lab found that older individuals are not able to elicit the same cell signaling response to acute exercise as young. Another way to stimulate the same cell signaling pathway is through phytonutrients such as those present in cruciferous vegetables like broccoli and broccoli sprouts. The aim of this study is to investigate whether we can improve the exercise response by treating cells with Sulforaphane (SFN), the active phytonutrient in broccoli. It is hypothesized that acute exercise and SFN will have a synergistic effect in older individuals. To test this, we will recruit 6 older individuals (≥ 55y) and take blood draws before and after an acute bout of exercise (30 mins @ 70% max). Mononuclear cells will be isolated from the samples and treated with SFN in cell culture. The cell signaling response will be compared between exercise, SFN, and co-treatment using measures of gene expression. The results will help design future studies on oral SFN supplementation and exercise.	Tinna Traustadottir	Biological Sciences
Leah Brennan	**Detrimental Effects of Sediment Loss and Erosion in the Pinaleño Mountains, Arizona**	The Pinaleño Mountains in southern Arizona were devastated by the 2017 Frye Fire. The high severity fire resulted in massive post-fire debris flows in multiple drainages within the mountain range. The post-fire debris flows have devastated watersheds, ecosystems, U.S. Forest Service resources, and could potentially affect downstream communities. The average annual area burned in the southwest has dramatically increased within the last century, altering physical properties of soils and increasing risk of severe erosion. To further understand the erosional processes that take place in between post-fire debris flows, I will measure the volume of sediment loss in Wet Canyon Ash Creek in the Pinaleño Mountains. Determining the volume of sediment loss will contribute crucial information to current research being conducted by a Northern Arizona University master's student, leading to a better understanding of post-fire impacts on ecosystems and downstream communities.	Taylor Joyal	SESES - Geology
William Carter	**Evapotranspiration volume estimation using daily flow-rate fluctuations: A high and low precipitation comparison of Bright Angel Creek**	Most components of the hydrologic cycle have been extensively studied, and have now been thoroughly understood, except for evapotranspiration (ET). Few methods exist to model volumes of water lost through ET, but some, such as the modified White method, have appeared to be successful. This study focuses on comparing ET rates from wet and dry years to draw correlations between ET and precipitation rates. With Bright Angel creek as a focus, this study intends to provide more ET knowledge to the scientific community, as well as provide very pertinent data of the main water source supplying all of Grand Canyon National Park (GCNP).	Abe Springer	SESES

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2018-19 Projects				
Jenna Chaffeur and Andrew Thomas	**Examining Water Storage Loss in the Wet Meadows of the Mogollon Rim Region of Central Arizona, United States**	The soils of the wet meadows of central Arizona store a significant amount of water. Recently, there has been incision down to bedrock in these meadows, affecting water storage capacity. Our research will determine the precedence of incision down to bedrock and provide data for how much water storage capacity has been lost due to incision. We will research two meadows that have not been affected by incision and two that have. Seismic refraction will be used to evaluate the amount of water-storing sediment available. The data will give us an estimate of the maximum water storage capacity of an unincised meadow. The same methods will be used in the incised meadows to calculate the water storage loss. At each incised site, we will sample charcoal at the base of the valley filling sediment and age it with radio-carbon technology to determine the last time incisionto-bedrock happened. The water loss data and the age of the charcoal will determine the precedence of incision to bedrock.	Taylor Joyal	SESES - Geology
Caden Chamberlain	**Comparisons of LiDAR and field-derived estimates of canopy bulk density and canopy base height in ponderosa pine forests in northern Arizona**	Recent trends of climatic warming in the southwestern United States are linked to increased frequency and severity of large wildfires in higher elevation ponderosa pine forests. Understanding different canopy fuel metrics in these forests is beneficial in fire behavior modeling which assists in fire management and fire effects assessments. Light Detection and Ranging (LiDAR) is a type of active remote sensing which has proven to be effective in measuring a variety of fuel metrics in a variety of forest types. The goal of this project is to evaluate the accuracy of LiDAR in estimating canopy bulk density and canopy base height in ponderosa pine forests of northern Arizona. A strong correlation is expected to be found between field-derived estimates and LiDAR-derived estimates, which will promote the use of LiDAR for producing metrics used in extensive, larger-scale fire behavior modeling. Because of rising trends in high-severity fires and the ongoing need for improved management and assessment of fires, this project is valuable in that it provides additional justification for the use of LiDAR in fire behavior modeling.	Andrea Thode	Forestry
Allison Cutler	**How to Incorporate Tolerances into Freshman Level Computer Aid Design Classes**	The purpose of this research is to evaluate Mechanical Engineering students' ability to understand tolerancing theory and implement tolerances into engineering drawings. ME180 Introduction to Engineering Graphics is a first year computer aided design course. Students are introduced to parametric modeling and the ASME Y14.5-1994 dimension and tolerance standard. The goal of this project is to evaluate a student's ability to properly tolerance using Clearance, Line, or Interference Fits. It is important for students to have a fundamental understanding of tolerances before proceeding to advance courses. The students will design an assembly with interchangeable parts that must meet the form, fit, and function of the assigned problem. The students will rapid prototype the parts and assemble them. They will then verify the tolerance they specified meets the requirements of the problem. If the parts do not mate, students will make recommendations to fix the assembly. If the parts mate, students will discuss why these tolerances were selected and make recommendations for change. I will evaluate these results to determine students' understanding of tolerances.	Perry Wood	Mechanical Engineering
Mildred Diaz	**The Effects of Forest Management Practices and Feedbacks between Plants and Soil Organisms**	Forests in the Southwest are commonly treated with controlled burning and thinning to help restore their health. While much is known about the effects of these treatments on the aboveground plant community and wildlife, little work has looked at how these practices impact the soil biota. This is important to study because soil biota influence plant productivity and soil carbon storage. Ectomycorrhizal (EM) fungi are found in the organic soil and colonize the exterior of the plant host roots. Arbuscular mycorrhizal (AM) fungi also form symbiotic relationships with plants, exchanging soil nutrients for photosynthetic product, but they form associations with the majority of forest understory species. Microarthropods are also an important part of the soil biota of the forest, contributing to nutrient cycling and influencing the composition of soil fungal communities. Our greenhouse mesocosm experiment will test the effects of thinning and burning on the abundance of AM and EM mycorrhizal fungi and soil microarthropods, as well as how these organisms interact to affect host plants.	Anita Antoninka	Forestry
Raymond Eckland	**Establishing mid-Cretaceous paleogeography recorded in the marble of Duck Lake in the Mount Morrison pendant of east-central Sierra Nevada, California using strontium isotopic analysis**	The focus of this project is to establish the paleogeography recorded in the mid-Cretaceous marble of Duck Lake that is stratigraphically constrained in the Mount Morrison pendant of eas-central Sierra Nevada, California. As this lens of marble is the only cretaceous originating subaqueous rock found in any Sierran pendant, it provides a rare opportunity to understand the early stages of the mountain range's formational history. Furthermore, it is direct evidence that may contend previous paleographic interpretations that the range had already risen above sea level during the late-Mesozoic. I hypothesize that the Sierra Nevada was still dominated by a marine setting during the mid-Cretaceous (104-99 Ma). I will use isotope geochemistry, facies characterizations and fossils to prove or disprove my hypothesis. The study will include field mapping and laboratory analysis.	Nancy Riggs	SESES - Geology

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Student	Project Title	Abstract	Faculty Mentor	Faculty Department
2018-19 Projects				
Charlotte Evans	**Impeding Bacterial Resistance to Antibiotics with the Deep Eutectic Solvent Choline Geranate**	Modern medicine now faces a shortage of drugs to treat bacterial infections, and the development of new antibiotics is crucial. Bacterial cells that have been exposed to numerous antibiotics often develop multidrug resistant (MDR) phenotypes which make them highly resistant to the medicines made to counteract them. Ionic liquids (IL) are a class of materials that have accrued attention as both an effective antimicrobial and antibiofilm agent. Many bacteria exist within a biofilm, a thick layer of extracellular polymeric substances, or EPS, coats the cells and provides a protective environment to the cells inside. ILs are known to be able to break up this EPS matrix, but many are also able to kill cells. Our lab believes that ILs kill bacteria because they enter the bacterial membranes and overwhelm them. One of the strategies that bacteria use to become resistant to antibiotics involves efflux of the drugs by membrane pumps, and we believe this process may similarly be interrupted by IL interactions in the membrane. The purpose of this project is to determine whether ILs may be able to disrupt the efflux pumps in the membrane and therefore sensitize drug-resistant bacteria again.	Andy Koppish	Chemistry
Kyle Ghaby	**Data Analysis of Cancer in Zebrafish**	Healthy animal cells perform aerobic respiration in the presence of oxygen, and anaerobic respiration when oxygen is absent. Most cancer cells, however, can mysteriously use anaerobic respiration in the presence of oxygen. Lactate, a major product of anaerobic respiration, may be acting as a signal to other cells to influence tumor growth. We propose a method of lactate-focused analysis and characterization of this phenomenon in zebrafish harboring human tumor cells, and zebrafish that spontaneously develop tumors as a consequence of genetic manipulation. The injection of cancer cells into a wildtype fish will provide measurements of different human cancers and their ability to grow in vivo under different physiologic environments. To model cancer occurrence in “high-risk” population we will use a genetically altered zebrafish line that predictably develops melanoma over its life span. The fish and or cancer cells can be manipulated genetically to inhibit their capacity for responding to lactate. We will systematically break different proteins that are candidates for lactate production or sensation which will test the requirement for these proteins in the spread of cancer. The goal is to identify novel therapeutic targets that can be leveraged for cancer treatments.	Matthew Salanga	Biological Sciences
Megan Gialluca	**Exploring Earth-like Planets Orbiting the Coolest Main Sequence Stars**	A number of potentially Earth-like planets have been discovered orbiting M stars (the smallest and coolest main sequence stars). As surveys for these exciting exoplanets continue, we expect the number of discovered exoplanets to continue to grow. With the discoveries of potentially habitable worlds comes the need to characterize these worlds to learn what these planets are like. Upcoming NASA missions, like the James Webb Space Telescope (JWST), and mission concepts, like the Origins Space Telescope (OST), may have the capabilities to study the atmospheres and surfaces of small, rocky exoplanets orbiting nearby M stars. Here, we propose to investigate what the true exo-Earth characterization capabilities of the JWST and the OST may be. We will complete this investigation by simulating what the spectra of Earth-like planets will look like, the extent of information and accuracy that the JWST and OST can detect, and how clouds on a planet’s surface will affect data interpretation.	Tyler Robinson	Physics & Astronomy
Alexander Henrie	**Shift of Ectomycorrhizal Fungal Communities in Pinyon Pine (Pinus edulis) and Ponderosa Pine (Pinus ponderosa) along an Elevation Gradient due to Climate Change**	Global climate change is predicted to affect multiple tree species of the southwestern US, leading to upward shifts in the elevational distribution of trees growing in mountainous areas like northern Arizona. Ectomycorrhizal (EM) fungi form beneficial associations with the roots of Colorado pinyon pines (Pinus edulis) and ponderosa pines (Pinus ponderosa), helping trees cope with warming and drying conditions. The EM fungal species associated with lower elevation pinyon pine and higher elevation ponderosa pine may differ, making it less likely that pinyon pine could successfully shift to a higher elevation site as the climate changes. I propose to examine the EM fungal communities of Pinus edulis and Pinus ponderosa along an elevational gradient to see if they share fungal species. I hypothesize EM fungal communities will differ significantly with elevation and among pinyon and ponderosa pines. I will test these hypotheses by comparing the EM fungi on the roots of pinyon trees moving up in elevation to ponderosa pine dominated forests. This study will improve our understanding of how EM fungi influence changes in plant species distributions with climate.	Catherine Gehring	Biological Sciences
Samantha Hershauer	**Barcoding ancient DNA from Alaskan lake sediment to detect foundation fish species**	Ancient DNA (aDNA) is an emerging field in genetics that is increasingly taking advantage of next-generation sequencing technologies. In an exploratory project, my team used aDNA methods to sample, extract, and sequence DNA found in sediment cores samples (sedDNA) from Lake Peters and Sunken Island Lake in Alaska. Preliminary metagenomic results indicated that fish DNA is well preserved in the sediments up to at least 4,500 years. To build on this investigation, I will use DNA barcoding (16S, 12S, and COI) to target fish, predominantly salmonids and three-spined stickleback, in sediment samples. My project will include a wider time span of samples, ranging from modern to 25,000 years ago. The results will be used to determine when the fish appeared in these lakes and whether ancient sedDNA can be used to understand past communities.	Faith Walker	Forestry

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Student	Project Title	Abstract	Faculty Mentor	Faculty Department
2018-19 Projects				
Oliver Kask	**Effect of Human Lactoferrin gene polymorphisms on the composition of the airway microbiome.**	This project will be examining if the composition of the human sinus microbiome is affected by polymorphisms in the lactoferrin gene. It is known that microbial communities in the human body are controlled by both environmental factors and host genetics. Yet there is not much research in to actual mechanisms of how host genetics effect the composition of the microbiome. This study will look in to the mechanism of how lactoferrin genotypes can affect the composition of the sinus microbiome. This will be tested through 16S rRNA gene sequencing for microbiome analysis using lactoferrin genotyping data as metadata.	Emily Cope	Biological Sciences
Landon Kuestersteffen	**Assessing Effects of Symbiosis between Soil Organisms and Vascular Plants For Mojave Desert Restoration**	The Mojave Desert is a vast expanse of land in the Southwestern United States that is often subject to degradation due to off-highway vehicle (OHV) use, resource extraction, construction of infrastructure, and the general public connotation of "wasteland". Because ecological restoration efforts have long been focused on mesic ecosystems, the array of knowledge available on dryland restoration is very limited. One particularly vulnerable ecosystem in the Mojave is in the unique gypsiferous soil system. This system has specialized biota, including: gypsophile desert shrubs, their corresponding arbuscular mycorrhizal fungi, a community of biological soil crust, and an array of critically endangered gypsum-endemic forbs. Restoration efforts to date have had little success getting these rare forbs to establish. The purpose of this research project is to create a greenhouse experiment to investigate how soil organisms (biocrusts and mycorrhizal fungi) and shrubs might impact the success of each other, and the germination and establishment of these rare forbs. Limited research has been done on this topic in dryland ecosystems. With this information, land managers will be able to assess the effectiveness of manipulating these relationships for restoration projects.	Anita Antoninka	Forestry
Jacob Lippert	**Mycorrhizae Impact on Forest Regeneration Post Severe Wildfire**	For 100 years wildfire has been excluded from the forest landscape, allowing the forest to become too dense and overgrown. For the last 30 years area burned and fire severity have increased leaving many landscapes with very large patches of tree mortality. It is necessary to begin research to better understand how trees regenerate in these very large high severity areas. My research intends to explore how mycorrhizae either presence or absence affect trees ability to regenerate in a large area that has experienced a severe wildfire.	Andrea Thode	Forestry
Lauren Mason-Sarantopulos	**Variation in temperature and nitrate tolerances in native and introduced amphipods of Northern Arizona, Hyalella azteca and Gammarus lacustris**	It is important to understand which of Earth's species will be able to persist when faced with multiple anthropogenic stressors. Amphipods are found throughout aquatic environments, including those in Arizona which host both an introduced species Gammarus lacustris, and native species Hyalella azteca. Factors such as rising water temperatures and pollutants from urbanization impact the resilience of these species. My goal for this project is to document the distribution of both amphipods across Northern Arizona's freshwater ecosystems, determine if Hyalella is found across a broader range of aquatic variables such as temperature, DO, pH and nitrate levels, and measure through lab experiments the short-term responses Hyalella and Gammarus exhibit to elevated temperature and nitrate levels. My results will add to our understanding of the resilience of native amphipod species compared to introduced species, as well as the relative importance of variation within vs. between species.	Rebecca Best	SESES
Jill Miller	**What the Death of Snails Can Tell Us About the History of Peck's Lake**	Peck's Lake, Arizona, is an oxbow lake cut off from the Verde River. Sediment cores from the lake are currently being studied by a team of international scientists from Northern Arizona University, The French National Centre for Scientific Research, and the University of Barcelona. They intend to use the data collected to draw conclusions about environmental change in Arizona wetlands and the relationship between vegetation history, climate change, fire history, and human history. There are whole sections of the sediment core with snail shells that have not yet been analyzed. These shells have the potential to provide essential information about changes to the ecosystem of Peck's Lake over time. I plan to conduct an analysis of these shells and correlate these assemblages to the data collected by the other scientists. This will provide useful environmental data to the study and improve our understanding of Arizona wetlands.	Scott Anderson	SESES
Falon Ortega	**Temporal-logic-based planning and control of autonomous robots**	This project aims to improve the performance of online planning and control of autonomous robots with guaranteed safety and satisfaction of specifications. Current technologies are either off-line and non-adaptive, or online and adaptive but slow and without guarantee. This project will develop a new computation method that improves significantly the real-time performance and responsiveness of the online planning and control algorithms, while guaranteeing that all task's goals and specifications are achieved. The method will be implemented in an open-source software toolchain. Demonstrations of the method and its software tool will be developed on a quadcopter experimental platform at NAU. This research would contribute intellectually to the field of autonomous planning and control of robots, and to the university's electrical engineering disciplines.	Truong Nghiem	School of Informatics, Computing, and Cyber Systems

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Student	Project Title	Abstract	Faculty Mentor	Faculty Department
2018-19 Projects				
Briana Palmiero	**Evaluation of plant moisture stress and overall drought tolerance in relationship to climate change in southwestern White Pine (Pinus strobiformis)**	The importance of this study is to determine whether increasing temperature with climate change will affect Southwestern white pines water intake enough to force migration or potentially cause extinction. This would affect food sources and habitats for small mammals, soil erosion, biodiversity, and overall air quality in mountain environments. I hypothesize that if seeds were taken from a warm climate under conditions to further heat them they will have little success. To carry out this experiment, we selected families of seeds from locations across southwestern North America, with half of the seeds being under a controlled condition to heat them in ventilated bags. We then planted these seeds in growth chambers with varying temperature ranges until germination, and finally conducted a pressure bomb trial on each to determine internal water potential. I expect that seeds from warmer climates and under more stressful conditions will have less successful germination rates and overall survival than seeds from cooler environments. This implies that trees in warmer climates are less prone to survival, and that at high enough temperature they will not be able to accumulate enough water and will eventually go extinct.	Amy Whipple	Biology
Benjamin Pieczynski and Bradley Moldermaker	**Clues to the formation of spiral structures in the Flocculent Galaxy M83**	Structures of spiral arms in disk galaxies are well studied, both through observations and theories, in the late twenty centuries (e.g. Toomre 1964, Lin & Shu 1985, Elmegreen 1991). However, with the Hubble Space Telescope (HST), high-resolution observations have shed new light on a lessunderstood type of spiral galaxy, the flocculent galaxies. These galaxies have multiple (more than four) short arms and “feathers”, which are stellar structures extending outwards from the arms. The formation of such structures currently is not well understood. For this project, we will be focusing on M83, a well-known flocculent galaxy. We will use its HST multi-band images to first determine the spatial distributions of star clusters within M83, based upon their different ages. We will then combine our results with data of molecular gas and dust distribution to study their correlation with clusters at different ages. We hope to further understanding in the formation of feathers in M83, and provide crucial information about the structures in flocculent galaxies.	Lisa Chien	Physics & Astronomy
Anna Ross	**Research on the Proposed LUVOIR, HabEx, and WFIRST Rendezvous Missions**	With the launch of space telescopes with increased observational abilities in the past two decades, scientists have discovered planets orbiting other stars. Since the first exoplanet discovery, over three thousand have been found. We are entering an exciting era of exoplanet discovery and characterization. While many exoplanets have been found, little is known about them. What information is known is commonly determined using transits, where the planet crosses in front of its host star. However, newly proposed space telescopes would use actual images of exoplanets to gain more information about their potential habitability. Dr. Robinson and I’s research will study the effectiveness of proposed telescopes in their ability to discover exoplanets and detect key spectral signatures in their atmospheres. We will use atmospheric modelling and spectral analysis to determine this. Our findings will be published in a peer-reviewed journal where exoplanet scientists can access our results.	Tyler Robinson	Physics & Astronomy
Chelsey Seaton	**Analysis of Groundwater recharge in a restored forest watershed using a novel measurement technique**	Water resources are being depleted for many reasons, such as climate change or impacts from humans like upland forest management. Monitoring multiple years of groundwater recharge with a novel measurement technique will allow for analysis of climate variability in a forested watershed. Climate variability is important because people and the environment rely on water to live, thus, when water supply varies each year, people must learn to adapt. The study will focus on a semi-arid climate, a region receiving low rates of precipitation, with deep unsaturated zones. This study will also allow for the separation of changes in recharge due to climate variability or from forest restoration treatments. A chloride mass balance (CMB) study will be conducted to estimate water recharge rates in the region. The area to be studied is in the Upper Lake Mary region of Northern Arizona and is watershed five located west of Mormon Lake.	Abe Springer	SESES
Kali Swichtenberg and Mark Ecker	**Phylogenomics of the Tok-Tokkie beetles (Tenebrionidae: Pimeliinae: Sepidiini): adaptive radiations and intraspecific communication in sub-Saharan Africa**	The Darkling beetle tribe Sepidiini (Coleoptera: Tenebrionidae) is primarily found in sub-Saharan Africa, where they are called “tok-tokkies” due to the loud tapping noise many species make to communicate with each other. Phylogenetic relationships within the Sepidiini will be examined in this study, as well as the evolution of substrate specialization and intraspecific communication through substrate tapping. Data will be gathered using specimens already collected by the Smith lab and next-generation sequencing methods, including high-throughput sequencing and targeted enrichment. Project results will be presented in the Ugrads symposium, at the Entomological Society annual meeting, and through scientific publications.	Aaron Smith	Biological Sciences

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2018-19 Projects				
Amber Treadway	**Influence of Market Integration on the Cardiovascular Health of Indigenous Ecuadorians**	Market integration, the transition from a traditional subsistence-based economy to a Western market-based economy, is rapidly occurring among indigenous populations throughout the world. Among the Shuar, an indigenous population from Amazonian Ecuador, the health implications of this transition are being documented by the Shuar Health and Life History Project (SHLHP). In 2013, the SHLHP conducted a study on the impact of market integration on the cardiovascular and metabolic health of Shuar adults, with results reporting mixed trends. Since 2013, six years of new cardiovascular and metabolic health data have been recorded. Thus, the objective of the proposed project is to conduct an updated analysis of the links between market integration and cardiovascular health among the Shuar using newly available data.	Melissa Liebert	Anthropology
Rebekah Turner	**Evaluating genetic variation at an anti-tick vaccine locus to improve eradication of cattle fever ticks**	Cattle fever ticks transmit lethal cattle fever parasites (Babesia spp.) for which no effective vaccines exist. These ticks and pathogens are endemic in Mexico and are at risk of reintroduction into the US, which imports up to 1 million cattle a year from Mexico. Cattle fever parasites can only be transmitted by Rhipicephalus microplus and R. annulatus ticks, therefore, disease prevention is aimed at tick control. One method of control is to treat cattle with an anti-tick vaccine that targets a tick midgut protein (Bm86) when ticks feed. It has been tested in southern Texas but is less effective than expected. I propose to investigate the genetic diversity of the Bm86 gene to address why the vaccine appears to have limited effectiveness in Texas. I will sequence the Bm86 gene in a diverse set of ticks that are resistant or susceptible to the vaccine. This project will help address why the vaccine is not always protective and predict modifications that could make it more effective.	Joe Busch	Biology, Pathogen and Microbiome Institute
Sierra White and Dakota Taylor	**Using Logic Diagrams to Examine a Socratic Argument by Analogy: Seeking a Clearer Understanding of the Obligation to Obey the Laws both for Citizens and non-citizen Immigrants**	In the Crito, Socrates is sitting in a jail cell when his friend proposes to bribe the guards so that he can escape and go into exile. The question, Socrates asks, is "what is the right thing to do?" In order to answer this question, he provides an account of the foundations of a citizen's rights and obligations under the laws using an analogy between the state and the family. Our plan is to utilize a system of logical diagrams for the sake of studying how arguments by analogy work so that we can more clearly see what makes some analogical arguments better and others worse as forms of reasoning. With these logical tools in hand, we will apply our research to select cases in contemporary U.S. law involving the legal and moral status of immigrants living in the United States. In doing so, we seek to see whether or not the Socratic argument by analogy can be extended in a natural way to cover relations between a state and immigrants living in a country who are not citizens. Having selected a small set of legal cases as good candidates for study, the two collaborating student researchers will draw on their research in logic for the sake of analyzing complementary sets of legal issues.	Jeffrey Downard	Philosophy
Fernanda Wolburg Martinez	**Crossing the Border: Work-Family Conflict Among Employees in Mexico**	Due to the globalization of the workforce with the advent of multinational companies, it is critical to understand how family-friendly workplace policies function in diverse cultural contexts. The proposed study will build off data collected from two multi-national car dealerships in Mexico City (Martinez, summer 2017). Surveys will be administered to U.S. employees working at car dealerships located in Arizona. Using the Job Demand and Resources model (Demerouti et al., 2001), work and family support, work and family demands, and gender roles will be examined in relation to the work-family conflict and wellbeing of a similar sample of middle-class employees in the United States.	Ann Huffman	Psychological Sciences
Victoria Wuest	**Defining species in a widespread Andean plant complex**	Lysipomia sphagnophila is an endemic cushion-forming dwarf herb native to the high Andes. Lysipomia sphagnophila has been divided into four subspecies based on morphology. However, since more areas have been collected, the vegetative and floral morphology are much more variable between populations and some do not fit the four known subspecies. This study will be used to understand the phylogeny and dispersal of the L. sphagnophila species complex. Deaver Herbarium specimens will be sorted into morphological groups based on similarity in measurements of leaves, flowers, and fruits. The leaves, fruit, and seeds from each group will be compared using the scanning electron microscopy (SEM). Polymerase chain reactions (PCR) will be performed on extracted DNA to sequence the nuclear ribosomal DNA spacers (ITS1 and 2) which will be processed and analyzed to create a phylogenetic tree. The resulting tree will aid in determining the distinct morphological characters for recognizing species and subspecies within L. sphagnophila complex. It will also help resolve whether there are undescribed taxa and the distribution pattern of L. sphagnophila.	Tina Ayers	Biological Sciences