Student Research Programs

2014 Summer Poster Session

ABSTRACTS

Photograph by McKenna Mitchell

Photograph by Victoria Janicke

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Photograph by McKenna Mitchell

August 13, 2014

Joe Crowley Student Union

Sponsored by the
University of Nevada, Reno
and the Office of Undergraduate
and Interdisciplinary Research

University of Nevada, Reno

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POSTER SESSION SCHEDULE

WEDNESDAY, AUGUST 13

Joe Crowley Student Union, Ballroom C

2:30 – 3:00 p.m.	**Sign in and hang posters**
3:00 – 4:30 p.m.	**Poster Session** Refreshments and appetizers will be served
4:30 – 5:00 p.m.	**Remove Posters**

PARTICIPATING PROGRAMS

EXPERIMENTAL PROGRAM TO STIMULATE COMPETITIVE RESEARCH (NSF EPSCoR)

The Nevada System of Higher Education (NSHE) received a Research Infrastructure Improvement (RII) Award from the National Science Foundation's Experimental Program to Stimulate Competitive Research (NSF EPSCoR). The *Solar Energy-Water-Environment Nexus in Nevada* project's mission is to advance knowledge and discovery through research on solar energy generation, its environmental impacts and the associated water issues, and accelerate this research by developing new capabilities in cyberinfrastructure in Nevada. Summer EPSCoR grant proposals are solicited annually in the spring semester. Successful proposals are funded up to $4,500 for the student and $750 for the faculty mentor. For details about the NSF EPSCoR Solar Energy-Water-Environment Nexus in Nevada program, or other Nevada EPSCoR programs, visit http://epscorspo.nevada.edu/epscor/

"This material is based upon work supported by the Nevada EPSCoR Program's Undergraduate Research Opportunity Program, funded by National Science Foundation under Grant No. IIA-1301726."

THE VALUE OF SNOW: SUMMER RESEARCH EXPERIENCES IN NATURAL RESOURCE ISSUES IN THE SIERRA NEVADA AND GREAT BASIN REGION (NSF REU)

The Academy for the Environment, which is dedicated to providing interdisciplinary research and education opportunities for students, and the Great Basin Institute, an environmental research, education and conservation organization, supported twelve undergraduates during their NSF-sponsored Summer REU program. Research teams worked in the Eastern Sierra Region of Nevada, specifically within the Lake Tahoe Basin and the surrounding northwestern Great Basin high desert, on studies ranging from interdisciplinary research, examining the various approaches to assessing, modeling, and managing water resources in the context of global climate change and diminishing snowpack. Participants were exposed to diverse scientific inquiries and technologies to glean how the socioeconomic and natural sciences inform land use policy and adaptive management of economic and natural resources. Students selected for the program were provided a stipend of $4,750, along with housing near campus during the ten-week program.

NEVADA INBRE - PART OF THE IDEA NETWORK OF BIOMEDICAL RESEARCH EXCELLENCE PROGRAM (NIH INBRE)

The Nevada IDeA Network of Biomedical Research Excellence (Nevada INBRE) is a statewide network of physical and human resources available to scientists in Nevada. Its mission is to provide infrastructure that enables investigators to successfully acquire research funding. INBRE research core facilities provide research support services, training, and equipment for Nevada's biomedical investigators. The program also sponsors research, scholarship and training opportunities for faculty members and students throughout the state with programs such as the undergraduate research opportunities program and the biomedical students' pipeline program.

NETWORK FOR EARTHQUAKE ENGINEERING SIMULATION - RESEARCH EXPERIENCE FOR UNDERGRADUATES (NEES REU)

The NEES REU program is a dynamic 10-week summer research program for upper division undergraduate students interested in Civil Engineering, Computer Science/Engineering, and other fields related to seismic risk mitigation testing. REU participants are paired with a faculty advisor, join a NEES research team, and participate in enrichment activities including attending the NEES Annual Meeting and the Young Researchers' Symposium. Mentors, including university faculty, researchers and graduate students, provide support and guidance to interns. Students are taught how to conduct independent research and how to participate effectively as a member of a research team.

PROGRAM SPONSORS

OFFICE OF UNDERGRADUATE AND INTERDISCIPLINARY RESEARCH

The Office of Undergraduate and Interdisciplinary Research works to foster an atmosphere of discovery and scholarship for all undergraduates, graduate students, and faculty. Interdisciplinary graduate programs and undergraduate research provide unique opportunities for students and faculty to address complex research issues of critical importance to the state of Nevada.

UNIVERSITY OF NEVADA, RENO

Established in 1864, the University of Nevada, Reno is Nevada's land-grant institution. Within the University, ten colleges offer undergraduate and graduate majors. Graduate-level training and research, including a number of doctoral-level programs, further the University's mission to create scholarly activity. The university is an integral part of the thriving Reno-Sparks area. Its 255-acre campus of rolling hills features a blend of ivy-covered buildings, sweeping lawns and functional, progressive architecture. The academic atmosphere is filled with rich surroundings for the cultural and intellectual development of students.

DOES VARIATION IN GEOGRAPHIC RANGE SIZE PREDICT VARIABILITY IN ADAPTIVE TRAITS OF STIPOID GRASSES?

Riley Anderson
Department: Natural Resources and Environmental Science
University of Nevada, Reno
Mentors: Elizabeth Leger, Lee Turner, Lynn Zimmerman
Program: NSF REU

Variability among populations may allow plants to adapt to changing environments such as climate change, land-use change, and altered disturbance regimes. Reseeding arid rangelands in the Western U.S. is often challenging due to limited precipitation and competition with invasive species. Some species or certain populations of species may be more variable than others in traits that allow them to establish more successfully in altered environments. If we can predict which species are likely to be most variable, those predictions could offer land managers more information about the species they choose to seed, which could result in more successful reseeding of degraded rangelands. I investigated the relationships between variability in seed weight and root phenotypic plasticity, potentially important traits for responding to drought stress and competition, with species range size along with precipitation data, minimum and maximum temperature, elevation range, and number of counties occupied. Four populations from each of eight species of needlegrasses native to Western North America were planted in high and low water conditions, and examined for variation in seed weight. Variation in seed weight was not related to latitude or longitude ranges, elevation ranges, number of counties occupied, or variability in temperature at the collection location. However, variation in seed weight was negatively associated with variation in precipitation at the collection location. That is, populations with less variation in precipitation had more variability in seed weights. These populations are currently growing in a greenhouse study to examine variability in root phenotypic plasticity in response to drought at the seedling stage.

PERCEPTION OF ROBOTS IN HETEROGENEOUS GROUPS OF HUMANS AND ROBOTS

Zoheb Ashraf
Department: Computer Science
Truckee Meadows Community College
Mentors: David Feil-Seifer
Program: NSF EPSCoR

The purpose of this project is to study the effect a team-building activity has on humans working alongside robots. This study compares a participant's perception of a robot (called Pioneer) due to a team building activity ("Two Truths, One Lie"). During this study the participants had 1-minute to find a hidden pen around the room. However the robot will be moving simply in a set pattern without using any input from its camera. The robot never located the hidden pen; it was always being the participants that found the pen. This task 2X2 study had two factors (team-building vs no team-building x group succeeds or fails at task. Before the study half of the participants completed team-building activities with the robot, the other half did not. Also, half of the participants would be able to find the pen; the other half would not since the pen was not in the room at all. Participants completed the survey after the activity asking the participants about their perception of the robot. The survey asked questions like impression about human teammates, and robot teammate. The study is in the progress, but the results will be compared to prior psychology research studying the effects of team-building on

human-human interaction for validation and comparison. Our hypotheses are human's perception of robot will improve after participating in the team building exercise with the robot.

HYDROTHERMAL CARBONIZATION OF PINYON-JUNIPER (P/J) BIOMASS

Kevin Bumgartner
Department: Mechanical Engineering
Truckee Meadows Community College
Mentor: Umakanta Jena
Program: NSF EPSCoR

Biomass has great potential for production of renewable fuels and chemicals. Biomass includes wood, forest residues, crops, crop residues, animal manure, sewage sludge, and algae. Pinyon-Juniper (P/J) is an invasive woody biomass that grows naturally in the U.S. west coast, including Nevada. There is an opportunity to use P/J for biofuel purposes. Hydrothermal carbonization (HTC) is a unique thermal conversion process that involves pressure cooking of biomass at 175°-275° C into a solid fuel, called hydrochar. Hydrochar has generally higher energy content and less oxygen content than the raw biomass and can be cofired in power plants to generate heat and electricity. The goal of the current research is to evaluate the HTC of P/J biomass and gather data that can be used to characterize HTC products at various experimental conditions and compare with the raw biomass. HTC runs were performed using bench reactors (batch-type) at the Bioenergy Laboratory at the Desert Research Institute. The conditions of the various HTC reactions were between 175°C and 275°C, and from 15 minutes to 30 minutes in duration. Data collection and analysis included: product yields (hydrochar, gases and water soluble products), product composition, properties of hydrochar (CHNSO, energy content, ash content). Hydrochar yield by dry weight of char compared to dry weight of Pinyon-Juniper biomass (feedstock) for the various experimental conditions ranged from 38% to 67%, depending largely on temperature and also on time duration of the reaction. A mass/energy balance for HTC was evaluated from the above data. Also, drying of the hydrochar of various production conditions was contrasted with drying of the raw feedstock.

WATER ACCESS CHALLENGES TO SUSTAINING AGRICULTURE ON THE HOPI RESERVATION

Janine Clark
Department: Geography and Regional Development
University of Arizona
Mentor: Loretta Singletary
Program: NSF REU

Water sustains Hopi life, religion and culture. The Hopi people have adapted to and thrived in an arid climate for hundreds of years. With future drought predictions and increasing global and regional demands for water, our research seeks to investigate the tribe's water rights, water availability and water quality in the context of sustaining agriculture on the Hopi Reservation. The tribe has water appropriation rights dating back to 1882, the year their reservation was established, under the precedent set by the Winters Doctrine. Although the exact quantifications to these rights are vague, some legislation has attempted to specify their apportionments based off of proposed water uses, future needs and the amount needed to sustain tribal activities. Water supplies are limited on the Hopi Reservation. The N-Aquifer, the tribe's main source of drinking water, is a primary water resource concern to the tribe as it is under stress from multiple users and risks arsenic contamination from mining activities as well as leakage of dissolved solids from the nearby D-Aquifer. Drought predictions and water management challenges will have repercussions to sustaining agriculture on the Hopi

Reservation because they primarily depend on precipitation for traditional dry land farming techniques. This research was conducted as a part of a report prepared for USDA officials on sustaining agriculture on the Hopi Reservation, a professional development resource and training guide for USDA program staff. The importance of water to Hopi traditions, culture and wellbeing emphasizes the urgency of appropriate water management, apportionment to the tribe and additional assistance in sustaining natural resources, like USDA programs.

DYNAMIN RELATED PROTEIN I AND ITS FUNCTION AT THE CALYX OF HELD

David Clark
Department: Physiology and Cell Biology
University of Nevada, Reno
Mentor: Robert Renden
Program: NIH INBRE

Neurodegenerative diseases such as Parkinson's disease, Alzheimer's disease, and Huntington's disease have all implicated mitochondrial dysfunction, and synaptic dysfunction as contributing factors. Dynamin-Related Protein 1 (DRP-1) mediates mitochondrial fission, and is critical for mitochondrial localization at the presynaptic terminal. In invertebrates, loss of mitochondria from the presynaptic terminal, due to DRP-1 deletion, results in decreased synaptic function. The role of DRP-1 at the synapse has not been tested extensively at mammalian central nervous system synapses. Using a well-characterized synapse in the mouse auditory brainstem as a model for understanding the role of presynaptic mitochondria, we hypothesize that DRP-1 at the presynaptic terminal is vital for structural integrity of synaptic vesicle (SV) clusters, and that DRP-1 serves an important function in SV recycling. Immunohistochemistry, confocal microscopy, and three-dimensional reconstructions of the presynaptic terminal reveal that DRP-1 consistently colocalizes with glutamatergic SV clusters in addition to its colocalization with mitochondria. Because DRP1 appears to colocalize with mitochondria and SV clusters, it is possible that DRP-1 has an important role in both mitochondrial fission and SV endocytosis, which is also a membrane fission event. Genetic elimination of DRP-1 is still needed to provide greater support of this hypothesis. DRP-1 expression will be locally eliminated using Adeno-Associated Virus in mice in vivo. Loss of DRP-1 will also elucidate the functional importance of mitochondrial localization to presynaptic function, and can be evaluated by electrophysiological experiments, in addition to confocal reconstructions.

PYROCHLORE STRUCTURED BISMUTH TITANATE WITH CO2+ IONS FOR SIMULTANEOUS VISIBLE LIGHT POLLUTANT DEGRADATION AND CLEAN FUEL PRODUCTION

Keenan Williams-Conrad
Department: Chemical and Materials Engineering
University of Nevada, Reno
Mentor: Ravi Subramanian
Program: GURA

Exploration of the usefulness of synthesizing Co^{2+} ions into an ecofriendly visible light active pyrochlore-structured photocatalyst bismuth titanate (BTO) to produce clean fuel, hydrogen gas, through photocatalysis is presented. The improvement to this photocatalyst is made by the addition of Co^{2+} ions into the photocatalyst BTO to make a composite. These ions are depositing on the surface of the photocatalyst greatly changing the characteristics of the BTO. The ions advance BTO's conductivity, by improving the band gap through an impurity band, and induce a red shift upon the catalyst causing a raise in the photocatalyst's responsiveness to visible light from solar energy.

The composite Co-BTO has demonstrated that the addition of the Co^{2+} ions has greatly improved the effectiveness of the photocatalyst in generating hydrogen, thus the composite Co-BTO is being used in tests to produce hydrogen, from a class of water based eco-toxin pollutant degradation. The hydrogen generation is performed in a slurry reactor under UV-visible illumination. This composite is synthesized by a wet chemical approach and is characterized by scanning electron microscopy, spectroscopy, and XRD analysis. Samples of varying levels of Co^{2+} in the BTO have been synthesized and experimented with so as to find that the 4% Co-BTO composition shows the greatest improvement in producing the most hydrogen from methanol degradation.

MODELING SHASTA DAM OPERATIONS FOR CHINOOK SALMON IN EXTREME WEATHER SCENARIOS AND CLIMATE CHANGE

Arthur Dai
Departments: Economics, Mathematics
University of Arizona
Mentor: Laurel Saito
Program: NSF REU

Chinook salmon populations have declined significantly after the construction of Shasta Dam on the Sacramento River in 1945 prevented them from spawning in the cold waters upstream. In 1994, the winter-run Chinook were listed as endangered and 3 years later the US Bureau of Reclamation began operating a temperature control device (TCD) on Shasta Dam that allows for selective withdrawal of water for downstream temperature control to promote salmon spawning while also maximizing power generation. However, dam operators [Ma1] are responsible to other interests that depend on the reservoir for water such as agriculture, municipalities, industry, and recreation. An increase in temperatures due to climate change may place additional strain on the ability of dam operations to maintain spawning habitat for salmon downstream of the dam. We examined the capability of Shasta Dam to regulate downstream temperatures under extreme climates and climate change by using stochastically generated streamflow, stream temperature, and weather inputs with a two-dimensional CE-QUAL-W2 model under several operational options. Operations performance was evaluated using degree days and cold pool volume (volume of water below a threshold). Model results indicated that a generalized operations release schedule, in which outflow release elevations varied over the year to match downstream temperature targets, performed best overall in meeting temperature targets while preserving cold pool volume. Releasing water all out the bottom throughout the year tended to meet temperature targets at the expense of depleting the cold pool, and releasing water all out the uppermost gates preserved the cold pool, but released water that was too warm during the critical spawning period. With increased air temperatures due to climate change, both degree day and cold pool volume metrics were worse than baseline conditions, which suggests that the Chinook salmon may be more negatively affected under climate change.

MN-MODIFIED $Bi_2Ti_2O_7$ PHOTOCATALYSTS FOR HYDROGEN GENERATION

Luis De León
Department: Chemical and Materials Engineering
University of Nevada, Reno
Mentors: Vaidyanathan (Ravi) Subramanian, Satyajit Gupta
Program: Faculty sponsored

The purpose of this research was to generate optimal hydrogen yield using a promising photo-catalytic arrangement. This arrangement consisted of a photocatalyst composed by bismuth titanate ($Bi_2Ti_2O_7$ – BTO) adjusted with manganese (Mn). Manganese with varying mass was incorporated to configure a modified BTO catalyst; the objective was to reinforce the opto-electronic and photo catalytic hydrogen generation aptitudes of the BTO. The geometrical, transformational, and visual characteristics of the photocatalysts were examined by X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), and UV-visible spectrophotometry. The XRD, SEM, and TEM evaluations showed generation of the pyrochlore BTO phase with particles of dimensions 30 and 10 nm. The UV-visible examination showed a reduction in the bandgap of Mn-BTO and a strengthen absorption in the visible range, compared to the original BTO. The photocatalyst was enhanced for optimal hydrogen generation from a water-methanol solution in a slurry reactor. The photo-catalytic hydrogen progression experiments showed that the Mn-BTO with up to 1 wt% Mn assists an optimal 140% increase in the hydrogen yield. The purpose of formaldehyde and formic acid as additives in photo-catalytic hydrogen advances has been evaluated. The outcome of manganese composition, the principle of operation, and the reusability of the photocatalyst are also examined.

INVESTIGATING DIENOGEST PHOTOTRANSFORMATION

Tatum DeMay
Department: Environmental Studies
Illinois Wesleyan University
Mentor: Ed Kolodziej
Program: NSF REU

Dienogest (DIE) is a steroidal progestogen, taken orally for use as a contraceptive, and used in treatment for endimetriosis. This compound readily undergoes phototransformation when exposed to sunlight. To better characterize its environmental fate, solutions of DIE in water and acetonitrile were photolyzed and photoproducts analyzed via high-performance liquid chromatography (HPLC). HPLC analysis suggests that photoproduct formation is solution dependent. Chromatograms from both solutions were compared, as well as DIE solutions in phosphate buffered water (pH 7). Photoproduct fractions were then collected, and stability tests were performed to investigate product to parent reversion mechanisms. These tests consisted of either acidifying products or heating at 35°C overnight. Following stability testing, one major photoproduct of DIE in H2O reverted back to the parent compound, while another product did not. The major photoproduct formed in acetonitrile did not revert back to the parent in any trials. Successive experiments are characterizing these products via NMR to elucidate their structures.

COORDINATION ENVIRONMENT OF A METALLOPEPTIDE MIMIC OF NISOD

Tyler Detomasi
Department: Chemistry
University of Nevada, Reno
Mentors: Jason Shearer, Jen Schmitt
Program: Faculty sponsored

Organisms must protect themselves from highly toxic reactive oxygen species (ROSs) through specialized enzymes that convert them into less harmful species. Superoxide dismutases (SODs) are enzymes that convert the ROS superoxide (O_2^-) into H_2O_2 and O_2. All known SODs are metalloenzymes that protect cells from O_2^- by catalyzing the disproportionation of O_2^- by cycling between reduced and oxidized redox states. SODs were known to possess Fe, Mn or Cu/Zn centers. A newly discovered SOD contains a Ni center (NiSOD); this SOD is the most common SOD found in aquatic life. The ligands around the Ni center bind through metal-nitrogen bonds which are rather uncommon in nature and surprisingly metal-thiolate bonds from cysteine residues. Normally these cysteinate sulfur atoms would be highly susceptible to oxidation reactions, but the electronic structure of the metalloenzyme fine-tunes the Ni-S bonds so it does not undergo oxidative decomposition. A continuing goal of our research into NiSOD is centered on understanding how the geometric structure of NiSOD contributes to the electronic structure, and hence its reactivity and properties. Utilizing solid state peptide synthesis, a metallopeptide mimic of NiSOD was prepared that will coordinate Ni(II) in an NS_3 coordination environment ($SOD^{m1}H(1)th$). Addition of Ni to the peptide yields $\{Ni^{II}(SOD^{m1}H(1)th)\}$. Spectroscopic studies in combination with electronic structure calculations provide insight into the electronic structure of the Ni(II)-center. This information will provide insight into how nature protects itself from oxidative damage.

CLATHRIN-MEDIATED ENDOCYTOSIS OF CELLULOSE SYNTHASE COMPLEXES IN PLANTS

Erica Dietlein
Department: Biochemistry and Molecular Biology
Truckee Meadows Community College
Mentor: Ian Wallace
Program: NIH INBRE

Cellulose biosynthesis in plants is not well understood, but it is clear that protein complexes embedded in the plasma membrane of plant cells, known as the Cellulose synthase complexes (CSCs), are primarily responsible for cellulose synthesis activity in both primary and secondary cell walls. These complexes contain Cellulose Synthase A (CesA) catalytic subunits which are constantly inserted into or removed from the plasma membrane. However, the process by which these complexes are endocytosed is not well characterized, nor are the interactions between the complex and other proteins known to be involved in endocytosis. In the plant cell plasma membrane, clathrin-mediated endocytosis (CME) is the main avenue for selective protein endocytosis and this process relies on a variety of proteins, including DRP1A, CLC2, TML, and AP2-µ1 (part of the AP2 complex). The purpose of this study is to examine potential interactions between CesA complex subunits and proteins involved in CME, in particular with the CesA subunits CesA1, A3, A7, through the use of the split ubiquitin yeast two hybrid system (sUS). A more complete understanding of which proteins interact with the CesA complex will provide mechanistic insights into the process of CesA endocytosis and could lead to tailored alterations in cellulose structure to enhance cellulose digestibility for biofuel/bioproduct production as well as beneficial textile or materials properties.

THE ECONOMIC IMPACT OF DROUGHT IN NEVADA

Jonathan Elliott
Department: Economics
University of Kentucky
Mentor: Tom Harris
Program: NSF REU

Recent multi-year drought in the American West, along with predictions made by climate scientists concerning future water availability, increasingly motivates research concerning the impact of climate change to local, state, and national economies. Nevada being the most arid state in the nation with limited water resources, this question of the impact of drought naturally brings to the forefront of the conversation an interest in the economic component of this issue. In order to quantify the impact of drought, I devise an input-output economic model for the Nevada economy using the microcomputer input-output modeling program IMPLAN. I verified and validated the IMPLAN data and model by correcting sectoral employment and agricultural industry production functions as needed to more accurately represent the structure of Nevada's agricultural industry. Using input-output analysis with direct water use coefficients for industry sectors, I estimate the direct, indirect, and induced effects of a reduction in water availability. This reduction in water resource availability reflects the recent drought in the Western United States and those predicted by climate scientists due to climate change. I estimate the multiplier effects of water availability changes in order to determine an estimate of the effects on the regional economy, specifically the economic, employment, and household income effects caused by reduced irrigation activity in the state's agricultural sector. I find that such a scenario negatively affects the output of several industries that have strong linkages to the state's agricultural sectors, namely other mining, food processing, and electricity for internal final demand, and residential construction, healthcare, water utility, and construction for export final demand. Moreover, I find that export final demand drives a large component of final demand output in agricultural industries, suggesting that there exists a substantial export of virtual water content, consistent with previous findings on the subject for the state of Nevada.

CHARACTERISTICS IDENTIFICATION OF CHLAMYDOMONAS AND MUTANT AND AUTOMATED PLATFORM DESIGN

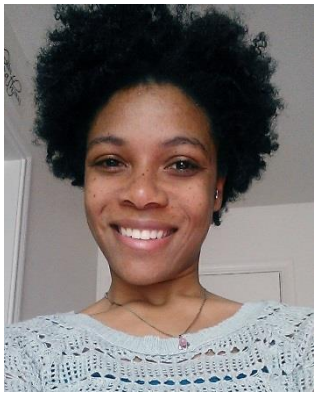
Jacob Hurd
Department: Mechanical Engineering
Humboldt State University
Mentor: Emil Geiger
Program: Faculty sponsored

Microalgae have been the subject of research for biofuel production. The focus of Plus Lab is to create microfluidic tools to assist in the research and cultivating the different strains of algae. The focus of this summer research was to observe and characterize two new strains of Chlamydomonas algae as well as finish the construction of an automated Plasma Pen platform for constructing microfluidic devices. To optimize algae as a biofuel resource lipid production must be maximized. Past studies have shown that Chlamydomonas algae produce maximum lipids when it is starved of its nitrogen resources. The two new strains of Chlamydomonas observed are a wild-type and a mutant which produces half as much lipids when its nitrogen resource is stressed. The growth conditions, growth rate, and lipid accumulation rate were the characteristics of

interest of these new strains. Mapping out these characteristics provides insights to improve sampling time as well as the improving the designs for the microfluidic devices that are being created in the lab.

The procedure used to construct microfluidic devices in Plus Lab requires the bonding of a glass chip to a Polydimethylsiloxane (PDMS) mold. A plasma pen is a tool that uses plasma to excite the molecules of the glass and PDMS so that they can bond on contact. To improve the constructability and reliability of microfluidic devises an automated plasma pen platform was desired to replace current hand construction techniques. An automated plasma pen would allow for a more even bond between the glass and PDMS then current hand techniques.

COLLABORATIVE ARCHAEOLOGY FROM AN AMERICANIST PERSPECTIVE



Dania Jordan
Department: Anthropology
University of Nevada, Reno
Mentor: Sarah Cowie
Program: McNair Scholars

This study will explore the nuances of collaborative archeology from an Americanist perspective by conducting a thorough literature review and assessing the parallels between Indigenous archaeology and African American archaeology. The study seeks to understand how archaeology is changing to better cater to the wants and wishes of descendent communities. This paper will identify the challenges and benefits of collaborative archaeology and how it changes the way archaeology is performed. For instance, a benefit of collaborative archaeology is that power is not granted to a single party, the archaeologist, but to multiple stakeholders. In doing so, many parties' objectives are being met and history can be interpreted rigorously through the archaeological record and with input from descendent communities. A challenge is negotiating conflicting goals and values among stakeholders. Additionally, case studies from both Indigenous archaeology and African American archaeology will be used to illustrate the best practices in collaborative research.

PLANT SPECIES DISTRIBUTION ON ALTERED-ANDESITIC SOIL PATCHES: HABITAT QUALITY VS. LANDSCAPE CONFIGURATION

Elana Ketchian
Department: Natural Resources and Environmental Science
Western Nevada College
Mentor: Peter Weisberg
Program: NSF EPSCoR

The desert mountains surrounding Reno, Nevada contain unique outcroppings of hydrothermally altered, andesitic soils that are extremely acidic and nutrient-poor. The isolated patches of altered soils contain a distinct "tree island" plant community of Sierran pines as well as understory plant species that are in some cases unique to these habitats, in other cases more characteristic of cooler, moister mountain climates. This plant community is in striking contrast to the adjacent sagebrush steppe vegetation that is more common for Great Basin landscapes. This project explored the question whether species distribution is influenced by the spatial configuration of the altered-andesite habitat patch network. We hypothesized that the probability of a species occurring in a given patch is positively associated with patch area and negatively associated with measures of patch isolation, after accounting for differences in local habitat quality. At 64 field plots, we sampled abundance of selected plant species and habitat quality variables, including soil pH, topography, and tree cover. Habitat configuration variables calculated in GIS included patch area and isolation metrics (proximity index and

Euclidean nearest neighbor distance). Plant species distributions were strongly associated with habitat quality but were not associated with habitat configuration measures. For example*, Eriogonum robustum, Pinus jeffreyi,* and *Pinus ponderosa* were acid-soil specialists, whereas *Eriogonum elatum* and *Eriogonum sphaerocephalum* avoided acidic soils. Tree cover also proved predictive of plant species distribution. *Eriogonum robustum* and *Eriogonum umbellatum* were found under sparse tree cover while *Arenaria aculeata* and *Eriogonum sphaerocephalum* occurred under denser tree canopy. Potential influences of landscape configuration on plant species distribution may have been masked by geographical clustering of sites within two areas that differed in patch mosaic structure: Peavine Creek and Hoge Road. Overall, plant distributions were weakly correlated with patch isolation metrics but more strongly correlated with soil pH, tree canopy cover, and elevation.

TRAJECTORY AND TIME DISTRIBUTION-BEHAVIORAL METHODS TO ASSESS SOCIAL INTERACTION IN A MOUSE MODEL OF AUTISM

David Legaspi
Department: Psychology
University of Nevada, Reno
Mentors: Maria Munoz Blanco, Linda Hayes
Program: Faculty sponsored

The epidemiology of autism spectrum disorders (ASD) has shown a significant increase over the past years (Newschaffer, et al., 2007). There is evidence that individuals diagnosed with autism exhibit histological changes in the hippocampus (Bauman & Kemper, 1994; Bailey et al, 1998; Kemper & Bauman, 1998). Part of the research on neuropathology includes the study of inflammatory changes in the brain (i.e. Welch et al. 2005). The Maternal Immune Activation project (MIA) was created to investigate the notion that the neuropathology of autism is caused at least in part by the brain's response to inflammation by providing a behavioral account of the most characteristic symptoms of autism. An experiment was conducted in order to compare social interaction behavior between the control and experimental mice and its relationship to deficits in social interaction seen in individuals with Autism. Autism spectrum disorder is defined in part by deficits in social interaction across contexts and individuals are seen to be sensitive to changes in their environment (DSM-V). Data collected from the social interaction experiment was collected and in the process of being analyzed with respect to the trajectory and time distribution. Trajectory measures were used in order to analyze the behavior of mice during the social interaction test while time distribution was used to analyze the proportion of time spent by each mouse throughout the social apparatus. Results have shown statistically significant differences between the groups with respect to approaches to another mouse, a new group of mice have been included in order to observe replications of the results. This research will add to the body of research with respect to the MIA as an animal model of autism. Further research is currently being conducted with respect to learning deficits and habituation tests.

VEGETATION STRUCTURE AND COMPOSITION IN PRE- AND POST-TREATMENT RESTORATION SITES IN SAGE-GROUSE HABITAT OF WESTERN NEVADA

Sarah Litz
Departments: Environmental Studies, Journalism
Loyola Marymount University
Mentors: Lee Turner, Lynn Zimmerman
Program: NSF REU

Greater sage grouse (*Centrocercus urophasianus*) are a candidate species for federal listing due in part to habitat impacts caused by encroachment of pinyon (*Pinus spp.*) and juniper (*Juniperus spp.*) trees in sagebrush communities. The pinyon and juniper species use valuable water, sunlight, and soil space that compete with sagebrush communities. To assess the efficacy of restoration efforts in sage-grouse habitat, we surveyed 18 sample plots located in the Walker Basin of western Nevada using the Assessment, Inventory and Monitoring method. 13 of these plots underwent pinyon-juniper thinning while five plots remained in untreated sites. We compared the structure and composition of sagebrush habitat sampled before (2011) and after (2014) restoration treatment. Additionally, we compared vegetation characteristics related to snowpack level. Following the 3-year study, density of invasive species decreased in treated sites from 2011 to 2014. There was no statistical evidence to suggest that a reduction in the change of invasive species density caused a reduction in the change of native species density. We also observed a decrease of sagebrush foliar cover in treated sites from 2011 to 2014. This could be due to many factors, including the method of removal, various effects of drought, and the short span of the study. Additionally, lower snowpack levels may have negatively influenced the structure and composition of sagebrush habitat in 2014. Sagebrush habitat is a valuable resource to the economically, socially, and biologically important species of the sage grouse. Further monitoring of longer-term effects of pinyon and juniper removal will provide valuable information necessary to make more refined management decisions by state, federal, and private land managers.

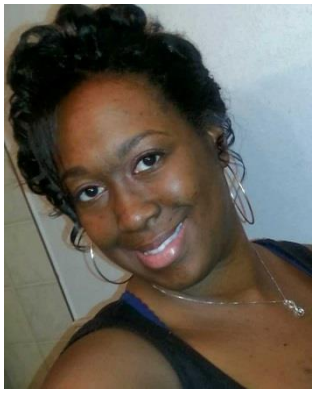
EFFECTS OF PRESCRIBED BURNING ON SURFACE SOIL FUEL LOADS IN THE TAHOE BASIN FORESTED ECOSYSTEM

Elektra Mathews-Novelli
Department: Forestry
Humboldt State University
Mentor: Paul Verburg
Program: NSF REU

Fire suppression has caused an unnatural build-up of fuel through top soil biomass with increased tree density in the Lake Tahoe Basin. These high fuel loads present a high risk for catastrophic stand replacing wildfires. Currently, fuel loads are being reduced by prescribed fire practices, reducing understory vegetation and soil litter density. In this project we are looking at changes in surface fuels (litter and duff layer) in response to fuel treatments over time. We have sampled four sites near Incline Village NV that have had different treatment histories with prescriptions ranging from 1 to 15 years ago. We sampled surface soil in a variety of sites using a gridded sampling design vs. a sampling design as employed by North Lake Tahoe Fire Protection District managers. One of our goals was to assess what sampling design best detects fuel treatment effects. We will determine the organic matter content by combusting the samples at 450^{o}C. In addition, we will measure available N fractions by extracting samples with KCl and water. With the results from this study we hope to be able to determine how forest fire management affects ground fuel load and N availability as a function of

time since treatment and what protocols are most appropriate for measuring changes in fuel loads over time. This information will help fuel managers to determine when sites need to be treated again to prevent build-up of fuels to undesirable levels.

A SEARCH FOR NEW FUNGAL SPECIES IN THE GREAT BASIN



Marcella La Shay Mayfield
Department: Biotechnology
University of Nevada, Reno
Mentors: Christie Howard, Ruth Gault
Program: GURA

Little is known about the diversity of filamentous fungi in the Great Basin. The research reported here is to begin to identify endemic species as well as species not previously thought to be in the Great Basin. Air samples collected for an unrelated study were utilized. To date, numerous samples have undergone tentative identification. This initial characterization has indicated the presence of species that had not yet been reported in the Great Basin. This current research study will confirm these findings and expand on these studies using macromorphology, micromorphology and molecular identification. In doing so, we hope to identify previously unreported fungal species from the Great Basin region as well as establish a data base of the endemic species. Further testing will be conducted on these species to conclude whether or not they are endemic or new to this area. This is novel information that will aid allergists/primary care providers to identify which potential allergens patients with respiratory disease are exposed to in the Great Basin.

SUBSPECIES IDENTIFICATION OF UNKNOWN TAXON IN BIG SAGEBRUSH (*ARTEMISIA TRIDENTATA*) COMPLEX USING MICROSATELLITE MARKERS AND SINGLE NUCLEOTIDE POLYMORPHISMS

Mark Mendoza
Department: Biochemistry and Molecular Biology
University of Nevada, Reno
Mentor: David Shintani
Program: Faculty sponsored

Accurate subspecies identification is vital to the understanding and management of big sagebrush sage grouse habitat. Microsatellite markers and single nucleotide polymorphisms are used in this project to identify the genetic relationships between a population of *A.tridentata* found in Nevada to two major subspecies *A.t. ssp.wyomingensis and A.t ssp. tridentata.* A subset of *A. tridentata* individuals found in Nevada and currently classified as belonging to subspecies *A.t. ssp. wyomingensis* displays morphological characteristics that are different from those found in Wyoming and may represent a novel subspecies or hybrid, Nevada sagebrush (unknown subspecies). By comparing the microsatellites of known subspecies to hundreds of unknown sagebrush samples, it can be possible to determine if the incorrect subspecies has been planted at some sites in Nevada. Genomic sequence data is used to design fluorescently labeled primers that are suitable for use in capillary gel electrophoresis to detect small variations in microsatellite repeat number. Primers targeting SNP sites will be designed as needed to work with genomic DNA and better capture SNPs in sequencing reaction. If Nevada sagebrush belongs to subspecies *A.t. ssp. wyomingensis,* it will have a similar microsatellite and SNP marker profile. Successful identification of the unknown sagebrush subspecies through genotyping will help determine proper restoration of the plant and its importance to sage-grouse nesting.

AN EVALUATION OF THE TRPA'S USE OF DESCRIPTOR VARIABLES IN SHORELINE SCENIC QUALITY ASSESSMENTS

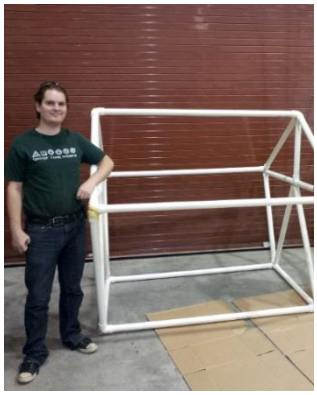
McKenna Mitchell
Department: Earth Science
Rice University
Mentor: Peter Goin
Program: NSF REU

Scenic quality is designated by the Tahoe Regional Planning Agency (TRPA) as one of nine environmental thresholds essential in the maintenance of Lake Tahoe's value to residents and visitors. Part of preserving the renowned scenic quality of Lake Tahoe is the evaluation and regulation of its shoreline as viewed from the water. To do so, the TRPA regularly assesses 33 shoreline units according to four previously defined descriptor variables: unity, variety, vividness, and intactness.

Although the TRPA states that these four descriptors are effective measures of scenic beauty, recent studies offer contradicting evaluations of their reliability. These studies reveal that "vividness" is the only descriptor with actual correlation to a non-expert observer's impression of scenic beauty (Clay and Smidt, 2004). In fact, "intactness" is shown to have no correlation to perceived scenic beauty, while "unity" and "variety" offer little information that is not covered already by the "vividness" score (Dell'Acqua et al., 2011). In addition, the TRPA presents little visual evidence as to what landscape aspects contributed toward each score.

This study critiques the TRPA's shoreline scenic quality management by evaluating the organization's assessment methodology and use of descriptor variables. A sample of viewpoints was selected with current "vividness" and "intactness" ratings that encompass the entire spectrum of possible scores. These views were rephotographed in an attempt to visually define and evaluate what the TRPA considers to be a "vivid" and/or "intact" landscape. This visual evidence, combined with an examination of the TRPA's assessment methodology, evaluates the TRPA's continued employment of descriptor variables in scenic quality management.

THE EFFECT OF HULL SHAPE ON CONCENTRATION AND REDIRECTION OF SURFACE WAVE ENERGY



Bryce Powell
Department: Electrical Engineering
Great Basin College
Mentor: Norm Whittaker
Program: NSF EPSCoR

For this project, a floating frame with a wave capturing system and a turbine coupled to an electric generator were developed to measure the effect that hull shape has on the concentration and redirection of the energy contained in the movement of surface waves on a body of water. The frame housed a flat panel that can be adjusted to varying angles of attack in relation to the incoming waves, creating either a deflection of or a shoaling effect on the incoming waves. This panel in turn housed an adjustable funneling device that captured, concentrated, and redirected the energy of the surface wave into a vertical water column that oscillated up and down. The oscillating water column in turn caused the air column above it to oscillate as well, and drove the turbine and generator. This oscillating energy level arises from the ebb and flow of the surface wave's crests and troughs. To measure the effect of the hull shape on the concentration of this energy, the output of a the small electrical generator was measured over the span of five minutes per hull shape, with the wattage levels being statistically averaged to give a single numerical value to that hull shape. A bladeless turbine was

designed and constructed in order to maintain a constant rotation of the generator's armature in the face of an oscillating energy input.

SEISMIC RESILIENCE OF PRE-TENSIONED BRIDGE BENTS

Eric Ramirez
Department: Civil Engineering
University of Texas at El Paso
Mentor: Islam Mantawy
Program: NEES REU

The ability of bridges to be seismically resilient is critical in reducing human losses and mitigating economic damage in the event of an earthquake. Several devastating earthquakes such as the 1994 Northridge California earthquake and the 1995 Kobe, Japan earthquake are notable examples where bridge and other structural damage resulted in human deaths and billions of dollars in damage. As such, a new, rocking, pre-tensioned bridge bent system has been developed for high seismic performance. The new bridge system, which was developed in collaboration between the University of Nevada, Reno and the University of Washington, decreases construction time by incorporating accelerated bridge construction methods, reduces post-earthquake residual displacements by incorporating unbonded pre-tensioned strands in the columns, and minimizes earthquake damage by using rocking connections at the ends of the columns. A prototype bridge system with the aforementioned characteristics and modeled to a quarter scale based on a typical highway bridge was constructed at the University of Nevada, Reno. The bridge was then tested on shake tables at the University of Nevada, Reno's earthquake engineering laboratory by undergoing motions which were used in a previous experiment for a conventionally built bridge system. The data obtained for the strains in the column longitudinal bars and the data obtained for the superstructure transverse displacements was then post-processed for three different ground motions and compared with similar data obtained from shake table tests conducted on a conventionally built bridge system. The comparisons indicate that the new bridge system induced lower strains in the longitudinal column bars than the conventionally built bridge system while the transverse displacements were higher for the new bridge system. These findings indicate that the new bridge system's pre-tensioned, rocking bent's provide better seismic resilience than bents that are built using conventional details.

CHARACTERIZING MICROCLIMATE CONDITIONS OF PIKA HABITATS IN THE GREAT BASIN

Keeley Rideout
Department: Geography
University of Colorado Boulder
Mentor: Tom Albright
Program: NSF REU

Microclimates occur when factors such as topography and vegetation influence ambient temperature thus causing the local conditions to differ from those of the broader surrounding climate system. The American Pika (*Ochotona Princeps*) depends upon a highly specific microclimate found in talus patches of high mountain regions of the American West. Pikas regulate their body temperature by retreating to the cool moist environment of talus. Climate warming may produce intra-talus temperatures inhospitable to pikas, and in an already isolated environment the species will be left without a home. Instances of pika extirpation have now been documented in the Great Basin. In order to characterize the highly specific microhabitat of pika populations, we deployed iButton temperature sensors in talus fields historically occupied by pikas. Specifically,

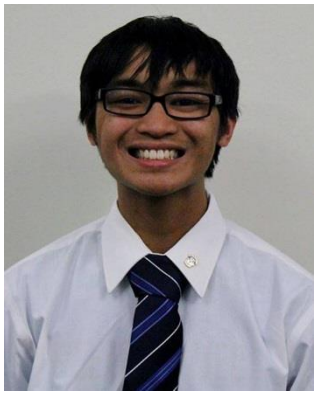
we sought to determine how intra–talus temperatures vary compared to temperatures directly above the talus and the surrounding air. Furthermore, we want to elucidate the correlation between temperature trends and pika extirpation in the Great Basin. Since 2006, temperature measurements were gathered every 4 hours from two meters above talus, directly above talus, and from interstitial sensors suspended within the talus at 31 different sites. Comparing diurnal, seasonal, and annual trends in temperatures from each stratum revealed the buffering effects of talus habitats in a region experiencing significant climate variability.

THE INFLUENCE OF DIET AND TEMPERATURE ON GROWTH AND MORTALITY OF AN ENDEMIC LAKE TAHOE STONEFLY (*CAPNIA LACUSTRA*)

Rae Robinson
Department: Biological Sciences
The College of William and Mary
Mentor: Annie Caires
Program: NSF REU

An endemic species of stonefly found in Lake Tahoe, the wingless *Capnia lacustra*, spends its lifecycle in unique deep-water macrophyte beds. Recent surveys of the lake have revealed the decline in *C. lacustra,* as well as these deep-water macrophyte beds. These declines are thought to be associated with decreases in lake clarity. Augmenting scientific knowledge of this species' ability to survive and grow with different food treatments as well as potentially stressful temperatures is important in the context of the changing habitats and clarity of Lake Tahoe. A 28 day diet experiment was conducted under two temperatures. Stoneflies were randomly assigned one of two temperatures (12-14 °C) and (8-10 °C) and one of four diet treatments: rhizoclonium (algae), chara (macroalgae), diatom felt, and brown moss. A control of no diet was also included for both temperature treatments. Five replicates were used per treatment. Stoneflies were kept individually in clear, 120 ml cups with their assigned diet treatments and incubated at assigned temperatures. Every 3 days, water was changed and old food was removed and replaced with new food. At the end of the experiment, growth rate (change in mass/time) and mortality were recorded. *C. lacustra's* response to different diets is of interest because it is possible that the composition of algae, the presence of macrophyte beds, and the availability of other food sources will change as Lake Tahoe's clarity changes. Also, this organism's ability to grow and survive under different temperatures is pertinent, especially in the face of recently increasing years of drought in the Tahoe Basin. The results of this study provide a basis for further, longer-term investigation of benthic invertebrate success under varied diet and thermal conditions.

EFFECTS OF FUNGAL ENDOPHYTES ON *LYCAEIDES MELISSA* OVIPOSITION PREFERENCE AND PERFORMANCE



Aldrin Santamaria
Department: Biology
University of Nevada, Reno
Mentors: Matthew Forister, Josh Harrison
Program: Faculty sponsored

Fungal endophytes are microscopic fungi that reside within plant tissues. Endophytes have been shown to provide beneficial effects to their host plants such as increased temperature resistance or a prolonged life span. However, while limited research has been done on the effects of endophytes on their host plants, even less research has explored the role of endophytes in mediating plant-insect interactions and their

subsequent effect on insects that feed on endophyte-infected plants. To investigate whether or not insects might either benefit or be harmed by endophytes, performance experiments involving *Astragalus canadensis* plants and *Lycaeides melissa* caterpillars were conducted to see whether or not caterpillars perform better with the presence or absence of endophytes in their systems; similar experiments to test the oviposition preference of adult female *L. melissa* were also done. Performance results show that male caterpillars perform equally well regardless of the presence or absence of endophytes while females do better with endophytes present. Oviposition results imply that adult females prefer laying their eggs on host plants with endophytes present. Although much research has still yet to be done, these early results imply that much like their host plants, specialist insect might also perform better in the presence of endophytes that engage in mutualistic interactions with their host plants.

MITIGATING WEB CRACKING IN POST-TENSION APPLICATIONS

Erin Segal
Department: Civil and Environmental Engineering
Lehigh University
Mentors: Brett Allen, David Sanders
Program: NEES REU

The Nevada Department of Transportation (NDOT) has observed during the construction process of post-tension bridge beams that web cracks were forming. Cracking leads to a greater chance of corrosion and high repair costs. During construction of post-tensioned beams, the beam is stressed and then the ducts are air pressure tested to ensure they can be grouted to create a bonded post-tensioned application. The purpose of this research project was to determine the factors that affect and cause the web cracking and present NDOT with enough information to adjust their construction process in the future. Six large-scale beams were produced. The properties were the same standards that NDOT uses but each varied in at least one of the following factors: duct path radius of curvature, spacing between ducts, and duct tie reinforcement. Each beam was stressed and air pressure tested to and above the amount NDOT protocols' state and monitored with strain gauges in various locations. To determine if further research should be devoted to determining if a change in the material of the ducts was a factor, small concrete duct specimens were also made. These were tested for compression strength and air pressure capacity. The large-scale beams illustrated that a smaller radius of curvature and greater spacing between ducts reduced cracking. The cracks were forming during the air pressure testing which put strain on the ducts and surrounding concrete. The addition of duct tie reinforcement helped keep the ducts in place and greatly reduced the amount of cracking. Therefore the major change that NDOT should consider at the present is to add duct tie reinforcement to post-tension applications which will reduce and eliminate the amount of web cracking occurring during construction.

LIGHT EXTINCTION CAUSED BY DUST DEPOSITION ON PHOTOVOLTAIC CELLS

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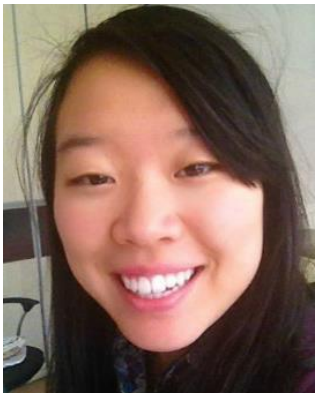
Department: Physics
Truckee Meadows Community College
Mentors: Hans Moosmüller, Nic Beres
Program: NSF EPSCoR

The objective of this study is to analyze the effects of mineral dust deposition on the amount and spectrum of light available to photovoltaic (PV) cells. Using the Desert Research Institute (DRI) dust entrainment facility, dust was suspended into a controlled volume and allowed to settle on ultrathin glass slides. The mass of dust

deposited was determined by weighing the slide before and after deposition. Shortwave solar radiation extinction through the soiled slides was quantified with a Perkin Elmer Lambda-650 optical spectrophotometer, yielding the spectral dust extinction from the difference of optical transmission between the soiled slides and a clean glass slide. The mass extinction efficiency was calculated as the extinction per mass per irradiated cross-section. Several dust samples were characterized, including natural dust from Reno, NV, USA, Yuma Proving Ground, Arizona, USA, and Bamako, Mali. Additionally, two samples of synthetic hematite (Fe_2O_3) were analyzed. We show the effects of dust composition to be very significant for the extinction of light. The directly proportionality between dust deposition mass and light extinction was supported by the results as well. Results of this study contribute to better understanding of the deterioration of PV system efficiency due to dust composition and deposition density. More recognition of these factors' effects will help optimize cleaning procedures and schedules in different locations.

DEVELOPMENT OF ENHANCED DATA ON ISOLATION BEARING RESPONSE FOR THE NEESHUB



Shirley Tang
Department: Civil and Environmental Engineering
University of Pittsburg
Mentors: Keri Ryan, Jean Guzman, Hamed Zargar
Program: NEES REU

Base isolation systems are a quickly developing earthquake mitigation technology. Their potential to preserve and protect nonstructural components in addition to structural components in the event of earthquakes proves an extremely valuable trait. Structures that provide essential services such as schools and hospitals need not only be left standing after an earthquake, but also must be functional shortly following the event. To better understand the behavior of structures following an earthquake, the NEES-TIPS: E-Defense Collaboration project, a joint effort between the University of Nevada, Reno and the Hyogo Earthquake Engineering Research Center, tested a full scale, five-story building in order to more accurately observe the reactions that base isolated structures exhibit in the event of seismic excitation. Additional advancement of base isolation systems has yielded the development of the gap damper, a supplementary system that can be incorporated into the base isolation system and designed to trigger only at periods of exceptionally violent seismic movements. The concept of the gap damper is being explored through the Gap Damper Collaborative project with the University of Nevada, Reno, and Auburn University.

This assignment involved creating enhanced data files from experimental data of the E-Defense Collaboration and the Gap Damper project. The enhanced data was then able to be uploaded to the NEEShub tool inDEED for additional data plotting, manipulation, and analysis. Additionally processed and documented video clips were rendered as an additional visualization tool for the E-Defense project.

The final products from the data enhancement of these two projects are available to the project teams as well as NEEShub users to improve understanding of base isolation technology. Users are provided with a way to process, visualize, analyze, and compare the experimental earthquake simulation data from the E-Defense and Gap Damper projects. The results lead to knowledge that can be integrated into a procedure to facilitate effective application of seismic isolation technology.

SPATIAL VARIATION OF SEMI-ARID MEADOW PLANT COMMUNITIES IN RELATION TO SOIL MOISTURE PATTERNS

Amanda Tate
Department: Natural Resources and Environmental Science
University of Nevada, Reno
Mentor: Keirith Snyder
Program: NSF REU

Spatial arrangements of plants in meadow environments are largely driven by depth to groundwater and soil moisture patterns. In semi-arid ecosystems, mixed meadow communities consisting of dry, mesic, and wet meadows are particularly complex and may vary by year depending on weather patterns. Understanding vegetation variability during variable weather years can provide important information for land managers, given these systems are an important source of forage for cattle. In this study, undertaken in a "dry" year, we measured soil bulk density and volumetric and gravimetric water content of the soil surrounding two groundwater piezometers within each type of plant community. These communities consist of dry, mesic, and wet meadow species. We measured soil moisture at a depth from 0-20cm every meter in a 6m transect in each of the four cardinal directions for a total of 24 points per piezometer. Soil bulk density and moisture content were measured at 3m in each cardinal direction at a depth from 1-7cm. The correlation between bulk soil density and volumetric water content was, as expected, inversely related for most areas surrounding the piezometers.

We surveyed vegetation transects in each community type and found distinct communities for each soil moisture category. One exception was in the wet meadow community where soil moisture was lower than expected in shallow soil. This soil had higher bulk density, which reduces porosity; possibly a result of cattle grazing. At adequate depth, soil moisture was available to support Nebraska Sedge (*Carex nebrascensis*), which was indicative of the wet meadow community. Another exception was a mesic area where soil moisture was higher than expected, but did not seem to affect plant community composition. Taken together these data suggest that soil moisture varies spatially and with depth and although correlated, does not fully predict plant composition.

AN ASSESSMENT OF THE TAHOE REGIONAL PLANNING AGENCY'S SCENIC QUALITY RATINGS

Danielle VonLehe
Departments: English, Photo Media
University of Washington
Mentor: Peter Goin
Program: NSF REU

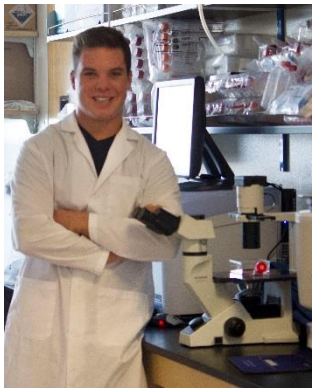
The Tahoe Regional Planning Agency measures Lake Tahoe's scenic quality in the effort to preserve the natural and human environment of the Lake Tahoe Region. To accomplish this, the TRPA adopted numerical scenic quality thresholds as a result of two scenic quality surveys in 1982 and 1993. Each scenic unit is assessed according to the following four previously defined aesthetic descriptors: vividness, unity, intactness, and variety. This allegedly objective quantification of a landscape as "scenic" cannot be valid given that one irrefutably must compare the landscape in front of one's eyes to the idealized landscape within one's mind, an inherently subjective act.

I attempt to demonstrate the ineffectiveness of this numerical rating system by performing a personal scenic quality assessment of D.L. Bliss State Park and Rubicon Bay, two scenic units rated by the TRPA. Although these units border one another on the southeast portion of Lake Tahoe, the scenic quality thresholds for each are vastly

different. D.L. Bliss State Park is rated over 30% higher than Rubicon Bay. I use the photographic medium to document this assessment. I align the visual data collected in my experience within the TRPA's scenic quality descriptors, but do not assign it negative or positive numerical values.

The visual data does not favor D.L. Bliss State Park over Rubicon Bay. It rather demonstrates how the unique scenic qualities of each do not easily fit into the TRPA's four aesthetic descriptors. I conclude the TRPA's rating system could be improved by expanding the visual vocabulary used to rate scenic units on Lake Tahoe. Rather than numerically rating units according to four uniform aesthetic descriptors, I propose the TRPA develop a new system of descriptors that balance a quantitative approach to beauty with more qualitative, variable judgment factors.

MTOR PATHWAY RESPONSE TO MECHANICAL STRETCH IN PREGNANT HUMAN MYOMETRIUM



Kyle Von Schimmelmann
Department: Pharmacology
University of Nevada, Reno
Mentor: Heather Burkin
Program: NIH INBRE

Mechanical strain is an important signal to the pregnant myometrium, which must expand up to twenty times its original size to accommodate the developing fetus, placenta, and amniotic fluid. Mechanical forces are known to regulate myometrial gene expression, cell growth, and contractility (Wu *et al.*, 2008). The mTOR (mammalian target of rapamycin) signaling pathway mediates cellular responses to nutrient supply, growth factors, energy availability, and stress. In addition this pathway regulates smooth muscle cell differentiation and contractility (Martin *et al.*, 2004) and birth timing (Hirota *et al.*, 2011). Increased endometrial mTOR activation was observed in two separate mouse models for preterm delivery and a single dose of the mTOR inhibitor rapamycin prevented preterm birth (Hirota *et al.*, 2011). Increased mTOR activation was also observed in an inflammatory model for preterm birth, suggesting increased mTOR signaling could be a common convergent pathway in many causes of preterm labor (Hirota *et al.*, 2011).

Our preliminary biaxial stretch experiments tested cultured Pregnant Human Uterine Smooth Muscle Cells stretched for 0, 10, 20, 30, or 40 minutes. We observed a significant increase in mTOR phosphorylation at 20 minutes of stretch that tapered off thereafter. We will next verify our cell culture model using freshly isolated smooth muscle tissue strips from disparate pregnancy conditions in order to determine if they can be replicated in tissue. We have performed mechanical stretch experiments on pregnant human myometrial samples and are testing the hypothesis that mTOR activation occurs in response to mechanical stretch in pregnant human myometrial tissue.

THE EFFECTS OF COBRA VENOM ON MITOCHONDRIAL SURVIVAL IN NEURONS

Boris Zhang
Department: Pharmacology
University of Nevada, Reno
Mentor: Ruben Dagda
Program: NIH INBRE

Objective: Snake venom cytotoxins (CTX) are highly basic amphipathic three finger fold proteins that interact and disrupt lipid bilayers from organelles including mitochondria. Mitochondria are critical regulators of neuronal metabolism, proliferation and survival. Cardiolipin is an anionic phospholipid enriched in mitochondria that serves to maintain mitochondrial function and integrity. We hypothesized that cobra cytotoxins are positively charged proteins that interact with cardiolipin in mitochondria to disrupt mitochondrial structural integrity and promote neurodegeneration.

Methods: Lactate dehydrogenase (LDH) release assays were performed to determine the 50% lethal dose (LD50) of cardiotoxin from *Naja mossambica mossambica* for all cell lines that were analyzed for mitochondrial function and toxicity in this study. ATP assays were performed to determine whether CTXs had a significant impact on mitochondrial respiration in intoxicated cells. In order to track the overall intracellular distribution and colocalization of CTX with mitochondria, the CTX was conjugated with rhodamine (CTX-rhodamine). The intracellular uptake and distribution of CTX-rhodamine was tracked by confocal microscopy in different cell lines and in primary neurons. Using the molecular modeling engine GROMACS, the interactions between molecular models of CTXs from *Naja oxiana* with 1-palmitoyl-2-oleyol-sn-glycero-3-phosphocholine (POPC) bilayer alone or a POPC bilayer containing cardiolipin were modeled using molecular dynamics techniques.

Results: Using molecular dynamics and molecular modeling techniques, we showed that CTXs are attracted to lipid bilayers containing cardiolipin. Moreover, exposing neuroblastoma to CTXs also showed a significant decrease in total and mitochondrial steady-state levels of ATP and alterations in mitochondrial structure suggesting that mitochondrial dysfunction is a mechanism by which CTXs promote cell death.

Conclusion: Overall, we show that CTXs are attracted to cardiolipin in mitochondria to promote cell death by disrupting mitochondrial function.

WHY UNDERGRADUATE RESEARCH?

Develop Skills to Conduct Research:
The job market is continuously evolving and the rate of change is fast because of the rapid development of new technologies. The job market is also highly competitive as employers try to be efficient and do more with less. An adaptable work force gives employers an edge and hence the ability to adapt is a requirement and no longer a luxury. Furthermore, effective communication skills are now essential in nearly all fields of practice. Undergraduate research teaches students the process of developing creative ideas, formulating and executing research and presenting the outcome. The skills learned through undergraduate research enable the college graduate to develop and adapt to new ideas and pursue them in a systematic way. The ability to communicate, both in written and verbal form, enhances the overall effectiveness of the individual and helps to make her/him a success.

Develop and Produce New Knowledge:
One of the major roles of universities is to create and investigate new ideas. Undergraduate students can be an important part of teams that that often involve graduate students and research associates, all operating under the guidance of a faculty mentor. Because of their fresh and unbiased look at new ideas, undergraduate students often strengthen the research team and can positively affect the direction of research.

To Motivate Talented Students and Recruit Them to Graduate School:
Many highly capable students do not pursue graduate degrees, frequently because of a lack of understanding about the possibilities that graduate education offer both during school and following graduation. The perception that graduate education is hard, costly and not rewarding is commonly overcome by becoming involved in research as an undergraduate student. The satisfaction that comes from solving a problem or attempting a creative endeavor that has not previously been attempted can create a new perspective and potentially encourage students attending graduate school.

Improve a Sense of Community and Group Dynamic:
The exposure of many students to the university setting is often limited to attending classes and occasionally meeting with an advisor. Undergraduate research provides a mechanism for students to interact more closely and frequently with faculty mentors and other researchers on campus. The improved sense of belonging and accomplishment enriches the educational experience of the student and provides opportunities to explore potential career paths.

http://environment.unr.edu/undergraduateresearch/

http://environment.unr.edu/undergraduateresearch/