# Program

<table>
<thead>
<tr>
<th>Session</th>
<th>Location</th>
<th>Presentations</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. SESSION A</td>
<td>Student Union 213</td>
<td>Science and Engineering Podium Presentations</td>
</tr>
<tr>
<td>II. SESSION B</td>
<td>Student Union 211</td>
<td>Liberal Arts Podium Presentations</td>
</tr>
<tr>
<td>III. SESSION C</td>
<td>Student Union 209</td>
<td>Business, Health Sciences, and Urban Affairs Podium Presentations</td>
</tr>
<tr>
<td>IV. SESSION D</td>
<td>Student Union 207</td>
<td>Interdisciplinary Lightning Talk Presentations</td>
</tr>
<tr>
<td>V. SESSION E</td>
<td>SU Ballroom A</td>
<td>Business and Hospitality Poster Presentations</td>
</tr>
<tr>
<td>VI. SESSION F</td>
<td>SU Ballroom A</td>
<td>Fine Arts, Liberal Arts, and Urban Affairs Presentations &amp; Exhibits</td>
</tr>
<tr>
<td>VI. SESSION G</td>
<td>SU Ballroom A</td>
<td>Health Sciences and Liberal Arts Poster Presentations</td>
</tr>
<tr>
<td>VII. SESSION H</td>
<td>SU Ballroom A</td>
<td>Liberal Arts and Sciences Poster Presentations</td>
</tr>
<tr>
<td>VII. SESSION I</td>
<td>SU Ballroom A</td>
<td>Science and Engineering Poster Presentations</td>
</tr>
</tbody>
</table>
EXHIBIT A

SCIENCE AND ENGINEERING PODIUM PRESENTATIONS
Sulfur-Phosphorous-Oxygen bonds are important bond units that compose the structural scaffolds of Thiophosphates, Phosphorothioate, and mixed Thiophosphates. This class of functional groups is present in a wide range of active pharmaceutical ingredients such as pesticides, biologically active molecules, and RNA linkages. Synthesis of mixed thiophosphates previously has been underdeveloped and challenging. Currently, the most widely used method to synthesize a mixed thiophosphate compound is through an Atherton Todd reaction. Atherton Todd reaction involves the formation of an air- and moisture-sensitive pre-functionalized \((R_1O)(R_2O)P(O)Cl\), which readily reacts with a nucleophile. To avoid this phosphoryl chloride intermediate, Dialkyl thiophosphate compounds were considered as alternative substrates. Dialkyl thiophosphate compounds are chemically inert and require activation. The Kang research group has previously reported a triflate anhydride/pyridine activation strategy for the synthesis of mixed phosphonates. We hypothesized that this activation strategy could be employed to thiophosphate compounds to synthesize mixed thiophosphates.

The reaction was first optimized to an 87 percent yield by manipulating molar equivalents of reagents, and screening different solvents/bases. Next, various Dialkyl thiophosphate compounds were evaluated to assess the reaction’s functional group tolerance. The scope of nucleophiles was then evaluated by testing diverse arenols, aliphatic alcohols, and naphthol derivatives. To conclude, a direct aryloxylation reaction of thiophosphates to synthesize mixed thiophosphates has been developed under metal- and chloride reagent-free reaction conditions. This reaction is high yielding, has broad functional group tolerance, was successfully applied to flow chemistry, and can be utilized for the synthesis of agrochemicals and biologically active compounds.
The bacterial cell envelope is the first line of defense against environmental stressors. In Pseudomonas aeruginosa, envelope stress leads to the activation of transcription factor AlgU via the breakdown of its inhibitor MucA. Because mucA is commonly mutated in P. aeruginosa clinical isolates and the protein is thought to be fully degraded in the cell, the gene is thought to not be required for cell viability. Here we show that mucA is, in fact, necessary for P. aeruginosa viability. Using a modified allelic exchange protocol, which provided statistical power to our analyses, we tested the requirement for mucA in various laboratory, clinical and environmental P. aeruginosa isolates with diverse phenotypes. Our results show that mucA is essential in all P. aeruginosa isolates we have tested, strongly suggesting that the necessary role of this gene is conserved in this species and is involved in an important basic process of P. aeruginosa.
Testing for Solid content percentage in Centrate, CFT, Solids, Return Activated Sludge, and Thickened Waste Activated Sludge in wastewater facilities varies among operations. The ability to confidently test these materials removed from wastewater can be accurately done with oven testing, but is unknown for microwave testing. Oven methods remain as the dominant form of testing for their reliability despite the requirement of a twenty four hour period to dry materials to produce accurate weights of solid material. Microwaves serve as a faster method to test materials for solid content, but different microwave technology and the variables of microwave settings interrupts the accuracy of test results. By regulating laboratory procedure along with optimizing microwave settings depending on style and age of the machine, the use of microwave tests can serve as a beneficial partner to wastewater facilities specifically here in Nevada. Reliable results lead to a more comprehensive understanding of how specific operations are functioning within the facility as well as the output weight of solid material removed from water that is ultimately sent to landfills. This allows us to conserve more water and produce less waste from the plant. Adjustments can be made to the centrifuges and polymer levels that assist in the dewatering processes of these materials to produce reliable numbers for solid content. Having confidence in the test results of solid content are helpful to the overall process of the facility and is environmentally friendly as there is more water to treat and reuse.
The efficiency of Cu(In,Ga)Se2-based (CIGSe) thin-film solar cells have continued to increase prominently in the last years, reaching over 23% on a laboratory scale. Such high efficiencies are usually achieved with a Ga/(Ga+In) (GGI) ratio of ~0.30. However, to also make use of the higher-energy photons in the solar spectrum, absorbers with a GGI ratio are of interest. Furthermore, the chemical composition of an absorber can affect the intermixing behavior occurring at the CdS/CIGSe interface of the device, with potential impact on the efficiency of the device.

To gain insight into the implications of absorbers with a GGI ratio of ~0.95, we used a number of different electron spectroscopy techniques to gather data on the electronic and chemical properties of our samples. By analyzing the intensity, energy, and shape of the spectral features, initial results for the intermixing behavior – and its impact on the valence band structure – were gathered and will be shown in view of the performance of the corresponding CIGSe solar cells.
In an interdisciplinary team of biologists and engineers, we designed and built a simple walking robot, referred to as Dynamic Control Platform (DCP), to investigate different control strategies based on bipedal walking. The primary algorithm is to maintain the orthogonal constraint—a perpendicular relationship between the center of mass velocity vector and ground reaction force vector. The actuation of the ‘ankle’ joint achieves braking or propulsion which changes the force vector’s direction. In our robot, we can only control for at most two degrees of freedom in a given walking stride. The ‘ankles’ are driven by DC motors located near the center of mass through a belt-pulley system. The heel and toe extensions of the foot are designed to be symmetrical. Changes from orthogonal constraint are determined each millisecond by 1) calculating the ground reaction force vector and 2) integrating the collected acceleration data from sensors to determine the velocity vector. We use mechanical cost analysis to analyze the walking dynamics of the DCP in comparison to human walking dynamics. This analysis determines the mechanical cost of transport of a walking stride, as well individual instances of high and low cost throughout the single and double stance phases of walking. While humans show appreciable mechanical cost in both phases of the stride, comparable measurements have not yet been made on a walking robot. Control algorithms developed in the DCP can reveal new strategies for bipedal walking gaits in robots and improve the function of powered prosthetics or exoskeletons.

This project was funded by the Office of Undergraduate Research SURF award, the RAMP Program, and the National Institute of General Medical Sciences.
The brain is an incomprehensibly complex organ, and our understanding of how it achieves many of its more advanced functions is still quite limited. Considering projected population increases in neurological disorders, such as Alzheimer’s disease and other forms of dementia, developing a better understanding of brain function is imperative to cultivate effective treatments for these disorders. In recent years, there has been a push to combine basic science methods with translational research tools in order to understand the onset and progression of neurological disorders. A promising tool for studying brain function is in vivo electrophysiology, a method by which researchers can record electrical function from within the brains of awake and behaving animals. This method has proven extremely effective when it comes to studying brain function. However, the current technology is often too cumbersome to allow animals to behave naturally and are much too heavy to utilize on smaller animal subjects, such as mice. For this project, we set out to design smaller, more lightweight devices to record data from a wider range of animal subjects, including genetically modified mouse models of Alzheimer’s disease. While further refinement is certainly necessary, we have successfully designed a lightweight recording device that can be used on a wide range of animal subjects.
Cross-Cultural Training and Engineering: An Illustration Using Vietnamese Engineering Faculties’ Responses to Nature of Engineering Instrument (Work-In-Progress)

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Faculty Research Mentor: Erica Marti, Ph.D.

Department of Civil and Environment Engineering and Construction

Engineering faculty have advanced experiences with engineering that non-engineers do not have, but what Nature of Engineering (NOE) concepts do engineering researchers hold? For K–12 engineering education, having an informed NOE understanding is an essential part of engineering literacy. Yet for the higher education engineering community, NOE is hardly ever discussed. Understanding engineering faculties’ NOE views can be a valuable contribution to current NOE research. Our project is part of a collaboration between a southwestern US higher education institute and a Vietnamese University. The cohort of Vietnamese engineering faculty is participating in training for research in environmental engineering for three months in the US. Vietnamese faculty is expected to improve their research skills at the end of the comprehensive professional development under the training of US environmental engineering researchers. Over the three months, Vietnamese faculty will search literature, learn lab skills and conduct a self-driven, lab-based research project in an environmental engineering lab. The purpose of our research is two-fold: Firstly, we will investigate what Vietnamese environmental engineering faculty say in response to the NOE instrument; secondly, the purpose of our study is to explicate the impact of a collaboration between a US university and a Vietnamese university. More specifically, our research study will identify NOE views of Vietnamese engineering faculty prior to and post-training. While Nature of Engineering (NOE) views are increasingly growing stateside, it is important to look at the views of NOE globally equally. Giving Vietnamese faculty research skills, hands-on laboratory projects, and US engineering research mentors; we will examine how Vietnamese engineers’ NOE views change working in environmental engineering research through interviews and open-ended written assessments. Although there are some attempts in assessing teachers’ and students’ NOE views, according to the authors’ knowledge, there is no prior research which assessed NOE views of international engineering faculty in a higher education setting. In this work-in-progress research, we will report the preliminary results of NOE understanding of Vietnamese faculty as a pilot study.
EXHIBIT B

LIBERAL ARTS PODIUM PRESENTATIONS
History? Can’t we just Google it?

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History is often described as being written for the victors and monotonous to learn. Little do people realize that history teaches us how to navigate situations and find the qualms of human behavior that caused devastating results. History is often a grave reminder of what ifs. Alas, it has been a debate between schools of whether or not to continue having History as a core class. History is incredibly dense and broad that we have to teach students the basics of American History. Therefore, I plan to research of why we do not include POC representation in US High School History classes, what other cultures think of history class in general which will tie in the themes of acculturation and globalization, and find out the opposing viewpoints such as Nationalists and their reasoning for trying to minimize history class in schools.

My research question is as presented: What are the benefits of teaching history to students, especially minority history, and why do people think of history as government propaganda designed to taint a child’s view of their country? To answer my question, I have peered into case studies on the effectiveness of teaching History in High School. I have also garnered numerous reports from historians and journalists on why incorporating History into the classroom have become advantageous in a person’s life. Regardless of which side of history you are on, there will always be a biased outlook, but students need to know how to critically analyze these perspectives.
The Helots of Sparta have often been a point of contention among historians due to a lack of surviving records that would conclusively prove their status. Many historians place them under the category of slaves simply because they were a conquered people. However, these historians fail to consider the idea of slavery in its ancient context. By analyzing the rules associated with Ancient Greek slavery and war, I present evidence that the Helots were not slaves by Ancient Greek standards. I also present the similarities between language associated with European serfdom and that of slavery. I argue that the history of Helots in the Spartan army, their secluded communities, and their marriage norms reflect those of medieval European serfs, not Ancient Greek slaves. I conclude that the Helots should no longer be categorized as slaves or as conquered peoples, but should instead be considered state serfs.

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South of Cape Flattery in modern-day Washington State, Ozette ("Oo-sa-ihlth" or ?use ?il) village, once stood like an ancient whaling village of the Makah nation. The Makah’s, the Cape people, lived in the Northwest for more than 4000 years and Ozette for 2000 of those years. The nation thrived on the sea. Their economy focused on the whaling, sealing, and fishing which increased their wealth and power. Their wealth left the Hawil or the provider at a higher level for trade with other Indigenous and eventually Europeans. Also, the sea played a role in the Makah society and social organization. Knowledge of whaling rituals and other spiritual ceremonies only based down from Hawil to Hawil. Rituals and ceremonies were critical in obtaining balance with the sea. If a Hawil did not provide or produce seas goods, he was not a good provider and replaced. Around 1750, a mudslide wiped out the Village of Ozette, part of the Makah Nation. 500 years later, it is unearthed and the “Pompeii of the West” is found. Between 1966-1981, an excavation brought Ozette back to life. It restored the Makah Peoples heritage and brought a better understanding of Indigenous and ancient American history. The Makah Nation Museum houses the 60,000 artifacts found. I will argue that the Ozette Village is worth preserving and memorializing to honor the Makah Nation and their history.
The vast majority of literature exploring the experiences of undocumented students in higher education has come from major states like: California, New York, and Texas (Bjorklund Jr., 2018). Very little research has shed light on the experiences of undocumented students in swing states that have remained “neutral” on educational policy and has shed very little light in examining factors that facilitate the academic success of undocumented students. Nevada as a swing state, is home to the largest share of undocumented immigrants in the country, making up 7.6 percent of the state’s population in 2012 and is home to 13,000 DACA recipients (Pew Research Center 2014). Using a Community Cultural Wealth framework (Yosso 2005), my study aims to explore the ways undocumented students overcome educational barriers, how they remain resilient and how they continue to maintain a sense of happiness under the current harmful anti-immigrant rhetoric by the Trump Administration. My study aims to contribute to scholarship by focusing on the resilience and joy of undocumented students in higher education in an under-researched state: Nevada.
In Maurice Blanchot’s 1955 text, The Space of Literature, ideas of death, space, and solitude are framed not by their typical significations, but as functions of signifiers. For Blanchot, solitude doesn’t emphasize aloneness; rather solitude provides concentration, while death is neither an act nor a cessation but a beginning. Clarice Lispector, a Ukrainian-born Brazilian author whose texts are often compared to the works of Kafka or Joyce, experiments with notions of solitude and death in her novels. The book I have chosen to examine is titled The Apple in the Dark, a novel often overshadowed by her other works.

The Apple in the Dark is a story about sexual difference, of guilt and innocence, and of solitude. I will be primarily focusing on the main character of the book, Martin, and the role he plays in the narrative, his relationships with Vitória and Ermelinda, and the possible reasons for why he decides to escape authorities by working on a rural farm. This book merits close analysis due to the nature in which sexual difference is presented within the narrative. Characters inhabit spaces of Otherness, while at the same time fitting their gender roles perfectly. The use of prominent poststructuralist, deconstruction, and second-wave feminist authors works will serve as a framework for understanding the complexity of the novel while also informing the reader how this investigation into sexual difference can enlighten us in the context of (post)modern feminist discourse.
Federal (e.g., Animal Enterprise Terrorism Act, USA PATRIOT Act) and state (e.g., “ag-gag”, eco-terrorism) legislation pertaining to animal rights activists have increased the likelihood that mainstream activists employing legal and non-violent are policed and surveilled (Amster, 2006; Glasser, 2011; Goodman, 2007; Greenberg, 2011; Sorenson, 2009).

Therefore, the purpose of the current study is to examine perceptions of surveillance among mainstream animal rights activists. This study is qualitative in nature and identifies themes from interviews with participants primarily based in Las Vegas, NV and Portland, OR.
The topic of Human Trafficking, while becoming more and more popular is one that is still vastly under discussed. There is a need to shed light on the topic and start a change in not only our nation but this world. In 2013 President Barack Obama gave a speech to the Clinton global organization discussing the topic, attempting to bring to light the much-needed change to the country.

Within the submitted paper, I will discuss the effectiveness of President Obama’s speech. I will critique the paper using the Neo-Aristotelian method and go into depth about the things in which Obama did that helped him to achieve his intended goal. Through his connection with the audience and ability to talk to the audience as more of a friend and less of a scholar, Obama was able to achieve the intended goal and shed light on the topic.
In this paper, I will distinguish the narrative features within the film, No Country for Old Men, that are being used to invite audiences to reflect upon a reality of a world filled with widespread violence, such as the setting, characters, plot, scenes, and lessons in the film, focusing primarily on the perspective of the character of Sheriff Ed Tom Bell. Using narrative criticism, I will demonstrate how the film, No Country for Old Men, offers a compelling narrative that engenders audiences to reflect upon a reality of a world filled with widespread violence, while also presenting a story of hope in the characterization of its virtuous protagonist, Sheriff Ed Tom Bell, that the audience will find relatable and meaningful.

In-depth analysis of this film is important because it provides a significant commentary on the senseless violence that is creating a climate of fear and anxiety among people in America today, such as acts of terrorism and mass shootings, while also offering tangible hope in the character of Sheriff Ed Tom Bell who personifies the resilient and honorable nature of decent human beings who are resisting against the evils of the world. Using narrative criticism, I will demonstrate the application of the method to the film, No Country for Old Men, and analyze the various interesting rhetorical features within the film in chronological order with special emphasis on scenes featuring Sheriff Bell. Lastly, I will describe the broader implications and conclusions that can be drawn from the film.
Food waste continuously destroys our planet year by year because it goes unnoticed and becomes forgotten. This creates a cycle of harmful trash in landfills, slowly seeping into the environment. Some people are unaware of the damages food waste causes to the planet, which has led the creators of Wasted! The Story of Food Waste (2017) to correct. This documentary displays important information about the process of food breaking down in landfills, climate change and global warming, contains interviews with chefs and environmental activists, and reveals images and facts about the environmental dangers of throwing away food.

In doing so, Wasted! has become a voice for the planet and a platform to raise awareness about an extremely important topic. It is also crucial to view, because it provides a unique lens for looking at food waste as immoral and an act of sinning. I argued that Wasted! is a direct call to action about the harms of food waste through the lens of sin. To further understand this documentary, and how it vocalizes blaming the viewer, as well as calling on them for help, I supported this argument by applying Kenneth Burke’s dramatistic method to the narrative told in the documentary. I isolate the act-agent ratio that guides the documentary, and analyze how it assigns guilt and points toward the preferred route to redemption.

This research was presented at the Far West Popular Culture Association in February 2019.
The purpose of this study is to assess nutrition comprehension based on the new Nutrition Facts label introduced in 2016. The new Nutrition Facts label seeks to simplify and enhance certain features that should make it easier for consumers to make better informed food choices. This study will quantify and compare consumer nutrition comprehension using the new Nutrition Facts label and two nutrition labels created for this study. This study seeks to answer the research question, which nutrition label is the most effective at improving nutrition label comprehension?

The goal of this study is to determine whether or not the new Nutrition Facts label is easier to understand, and if there are more effective methods to improve nutrition comprehension. This research will be a randomized, controlled survey study, with quantitative techniques. Participants will be college students and given one of three surveys with a nutrition label. Participants will either receive (1) the new Nutrition Facts label (control), (2) the new Nutrition Facts label plus high/medium/low text for saturated fat, sodium and added sugars or (3) the new Nutrition Facts Label plus a traffic light method for saturated fat, sodium and added sugars. All surveys will contain the same nutrition comprehension questions and nutrition label usage questions. I hypothesize that group two, participants using the new label with the high/medium/low text, will demonstrate the highest nutrition comprehension. Nutrition comprehension and label use will be determined with closed-ended questions. Outcomes will be compared using ANOVA. All analyses will be conducted using SPSS.
Although 33 states and the District of Columbia have legalized the use of medicinal and/or recreational marijuana, the industry as a whole still faces challenges related to a lack of financial services. Without institutionalized financial services (banks and credit unions), the marijuana industry operates largely on a cash-only basis; this has consequential effects on regulatory matters for stakeholders and residents in areas that have legalized marijuana. My research aims to develop a feasible policy solution to address the discrepancy between federal banking law and state marijuana laws so that cannabis businesses can access the financial services available to practically any other industry. My research approach includes an analysis of federal banking laws, state marijuana laws, and societal context, such as historical and current underpinnings.

I have interviewed experts in marijuana and banking policy, and have collected data from news reports, policy briefings, and books on marijuana history, policy, and law. Preliminary results indicate that the best solution for addressing the discrepancy between banks and the marijuana industry is a policy change in how the U.S. Treasury treats financial institutions that service cannabis businesses. Ultimately, federal policy change within the U.S. Treasury Department will smooth out and fairly regulate the relationship between banks and state-legal marijuana companies. This will, in turn, transition the marijuana industry away from a cash-only basis. Through my research and policy recommendations, the risks associated with the current marijuana banking landscape can be remedied for stakeholders at the federal, state, and local level.
INTERDISCIPLINARY LIGHTNING TALK PRESENTATIONS
This research investigates the extent to which pathogenic mutations are located on the C-termini of proteins in the human proteome. Proteins are directionally translated from the N-terminus to the C-terminus. We define C-terminus for the purposes of the project as being the last ten amino acids in a protein. There are eight pathogenic C-termini mutations supporting our hypothesis that many other mutations on C-termini may cause human disease. We addressed this hypothesis by analyzing existing data sets from the National Center for Biotechnology Information (NCBI), the Broad Institute of MIT and Harvard, and the Schiller Lab. NCBI’s RefSeq Reference Genome Annotation and ClinVar database were especially important. The gene coordinates of the C-terminus for each coding sequence were derived from the Reference Genome Annotation file. Variants from ClinVar were identified within a coding sequence and filtered based upon their pathogenicity. These variants were matched where possible to their corresponding entries in the Broad Institute’s gnomAD data to assess variant frequency. Data collection and analysis were performed using a custom Python program. The resulting data set records C-termini variants by category of pathogenicity, the frequency of pathogenic variants, the diseases caused by the variants, and the genes that possess pathogenic variants. Preliminary findings suggest the presence of around 50 pathogenic and likely pathogenic variants. Future work currently in progress will analyze how C-termini variants disrupt minimotifs, short amino acid chains in a protein that perform a specific function, using the Schiller Lab’s C-Terminome database.
Recently HPV-16 and 18 have been found in the oral cavity and have been significantly linked as causative agents of oral cancer. Research has also shown the effects of HPV on breast cancer cells. More recently, HPV-16 and 18 have been found in normal breast tissue. The carcinogenic effects of HPV on oral and breast tissues have been demonstrated; however, the effect of HPV on non-cancerous breast tissue cells has not yet been studied.

**Objectives:** Based upon this information, the objective of this study was to evaluate the effects of HPV on normal breast tissue.

**Methods:** HPV16 and HPV18 strains were used to infect normal, non-cancerous breast tissue cell lines Bst–Hs578 and 18485 in vitro. Cellular growth and viability was evaluated to determine if HPV mediated any of these cellular phenotypes. Cells were plated into 96-well assay plates to measure proliferation. Viability was measured using a BioRad TC20 automated cell counter.

**Results:** Bst–Hs578 plus HPV-16 resulted in 619% increase in proliferation compared to control cells (no HPV) and viability increased by nearly three-fold (18.2% vs. 54%). Bst–Hs578 plus HPV-18 resulted in 806% increase in growth compared to the control after one week of incubation with viability increasing by more than two-fold (18.2% vs. 40.2%). These experiments are now being conducted on 18485 and HGF-1 normal, non-cancerous cells.

**Conclusion:** Although studies have demonstrated that HPV can modulate oral and breast cancer cells, no studies to date have demonstrated that HPV has the potential to mediate the growth or viability of normal, non-cancerous breast tissue. This study may be among the first to demonstrate that HPV is capable of modulating these phenotypes in normal, non-cancerous breast tissue – which will be important for dentists, oral healthcare professionals and epidemiologists who are interested in HPV prevention and vaccination.

*Funding for this project was provided by the 2018 Office of Undergraduate Research (OUR) SURF award.*
Humans commonly synchronize their movement with rhythmic stimuli, such as music. It is assumed that listeners do this using the perceived beat (periodic pulse) in the music. While we know that adult listeners can maintain the beat once it is perceived, it remains unclear when this ability develops and what neural mechanisms underlie this ability. In two experiments, we investigated 1) children’s ability to maintain a musical beat percept, even in the absence of disambiguating beat information, and 2) whether steady state-evoked potentials (SSEPs, electrocortical activity from a population of neurons resonating at the frequency of a periodic stimulus), as measured by electroencephalography (EEG), reflect the beat perceived and consciously maintained by the listener. In both experiments, participants listened to a musical excerpt that strongly supported one of two beat patterns (context phase), followed by an ambiguous rhythm that could be perceived as having either beat pattern (ambiguous phase). Finally, a drum was superimposed over the beat-ambiguous rhythm that either matched or did not match the beat of the context (probe phase). In Experiment 1, older children accurately rejected probes that did not fit the context and accepted probes that matched, while younger children did not perform above chance. In Experiment 2, we measured SSEPs while the children accurately maintained the beat (ambiguous phase). Preliminary data show that some children exhibit higher amplitudes at frequencies corresponding to the maintained beat. These findings suggest that SSEPs reflect perception of musical rhythm across development and not just stimulus encoding of temporal features.

The research has been presented at SMPC 2017, SRCD 2017, ARO 2016, and ICMPC 2016, and will be presented at RPPW 2019 and SMPC 2019.
During the seventeenth century, Spanish officials entered the Sierra Madre Occidental, a Rarámuri homeland. Located in Southwestern Chihuahua, Mexico, the Sierra Madre Occidental is a high terrain region that contains rivers, lakes, mountains, and a system of several canyons. Rarámuris lived in the midlands and highlands of this mountainous terrain for hundreds of years before Spanish officials entered the region. In the early 1600s, Spanish Jesuits established missions in the region’s lowlands and attempted to convert Rarámuris to Christianity.

Furthermore, in the late 1600s, Spaniards discovered gold and silver in the Sierra Madre Occidental. To access and extract these resources, Spanish miners settled on Rarámuri lands and exploited Rarámuri labor. Spanish official correspondence and government reports reveal that to rid themselves of Spanish control, Rarámuris organized multiple rebellions against the Spanish and then retreated further into the highlands. These documents demonstrate that Rarámuris utilized the geography of their homelands to resist the processes of Spanish colonization. They utilized the Sierra Madre Occidental to fight for the survival of Rarámuri communities and culture.
Notable industry researchers have concluded that hotel products and service delivery systems need to change from original designs if hotels want to develop loyalty from new incoming generations. Previous research studies have focused on the impact of technology amenities on hotel booking decisions; an extensive review of related literature revealed no emphasis on the potential impact of technology amenities on the booking decisions of Generation Z hotel guests. The purpose of this study is to explore and examine the potential influence of hotel technology amenities on booking decisions for Generation Z. Particular emphasis should be placed on Generation Z, for whom there isn’t a concrete understanding of technology adoption but is yet the fastest growing generational market segment in the travel industry.

Obtaining a holistic view of the guest experience is vital to developing an understanding of Digital Native preferences, and ultimately understanding potential motivational and delaying factors of technology adoption. The non-probability technique of snowball sampling will be used as a part of a class exercise where 120 students enrolled in HMD 226 Computer Applications in Hospitality and Tourism will be invited to volunteer in the study. An online survey adopting a total of 37 items from recent scholarly studies will be presented in a 5-point Likert scale format and encouraged to be forwarded to five friends who are between the ages of 18-20.
My inspiration for a Better Hospitality Robot system was my encounter and interaction with Ivy, from Go Moment, at Harrah’s Resort Southern California. What if there’s a robot that can understand jokes better, or can understand what people mean better, when people say things? How do you promote robot vendors who come up with the next big thing in robot AI?

Because of the leaps made by Google's DeepMind, IBM's Watson, Apple's Siri, Amazon's Alexa, and numerous other AIs, including those from video game makers Blizzard and Riot, robots and AIs may be increasingly better at tasks once thought to be masterable only by humans, such as Chess, Go, Texas Hold’em, Jeopardy, Atari video games, and now driving, writing music, poetry, debate, and of course flying, jumping, manufacturing and assembly, and so on.

But can AIs learn to be relatable to humans in such a way that humans prefer the company of robots, rather than other humans? Can robots be more likeable than even humans can be? One possible way to ascertain this is figuring out what makes people relatable to other people, and seeing if this quality of wanting to be relatable to other humans can be put inside robot AI. The idea is that if robot AI already know how to compete against humans, can robot AI learn to want to be liked by humans? Can the robots, by interacting with humans, help humans become better than robots? Can humans, by interacting with robots, learn to be better than robots?
When looking at the housing market, there are a lot of determining factors that negatively and positively affect the price. Hedonics allows economists to evaluate the importance, impact and value of various home characteristics.

Whether it be a pool, square footage, location, or even the amount of bath rooms, everyone has specific “needs” when it comes to purchasing a home. This paper is going to examine and analyze these characteristics, determine which have the biggest impact on home prices, and if they are relevant to the dependent variable.
In the US, legislators make very important budgetary decisions affecting millions of youth in the publicly funded school system. Education is emphasized in hopes to gain a competitive edge in a world where human capital is increasingly important. However, American taxpayers ought to track whether their investment is truly paying off, so to truly gain from it.

This empirical study uses data from the National Center of Education Statistics (NCES) and the US Department of Education to investigate whether an increase in per pupil spending improves student academic performance (measured by state-level student average science test scores).

Drivers of test scores are measured through state per pupil funding and expenditures. School funding sources are federal, state, local, and other sources, whereas pupil expenditures include purchased services, tuition and voucher payments (to other local education agencies and charter schools), and supplies.
The focus of our project will be on hedonic models with focus on how the location of elementary schools affect the prices of the houses, specifically looking at Henderson and Summerlin. We will be utilizing data from the Las Vegas Metropolitan housing market and schools in these neighborhoods. We make use of the hedonic model where we organize the real estate attributes in a panel structure. We assume that the price of a house reflects the incorporated characteristics valued by some implicit price.

This is to be able to accommodate non-linearity, variable interaction, or other complex valuation situations amongst the characteristics. By using a Hedonic price model we will help to show how the value of a good such as real estate assets are based off of their characteristics like amenities, square footage, number of bedrooms, etc. Hedonic price models are important because they help in calculating the extent that these characteristics affect the price of a home. Evidently, using the Hedonic price model can be very useful in economics because it can be used to estimate values and use data that have direct impact on market prices for real estate assets.
Renewable Portfolio Standards (RPS) are a kind of command-and-control regulation used to help limit the amount of emissions released throughout the country. The effectiveness of this regulation, however, is questioned when weighing its costs and benefits. An RPS encourages utilities within a state to produce a certain percentage of their electricity from an approved renewable energy source. This transition might be costly due to the production costs a utility will face in order to meet the standard. Alternatives to renewable energy, such as coal, natural gas, and other polluting sources, are a cheaper way for utilities to produce energy—especially within states that have lower renewable energy potential.

Another concern is with states adopting the policy while having a regulated energy market. Such states might be subjected to higher prices since the lack of market competition might prevent an optimal price for consumers. This thesis focuses on the effects of implementing an RPS on residential electricity prices. Past studies conclude that an RPS does drive up electricity prices; however, this paper will focus on using the most recent data to understand the exact effects of an RPS within states that have adopted the policy. The main concern is to determine by how much electricity prices rise and whether a deregulated energy market will help make the command-and-control policy more affordable for residential consumers.
This paper seeks to examine the phenomenon commonly known as the motherhood wage penalty. The motherhood wage penalty refers to the situation in which women experience a decrease in lifetime earnings along with foregone career opportunities following the event of having a child. The same occurrence has not been observed in males who have children and this is often believed to be the primary driver of the persisting wage gap between men and women.

Our project seeks to analyze the effects of the motherhood wage penalty as it specifically pertains to women’s lifelong wages, which will be measured as the natural log of wage. We will examine longitudinal data on women’s labor outcomes and control for a number of factors such as race, age, age squared, marital status, number of children, experience, experience squared, whether employment is part-time or full-time, type of occupation, and resources available to the woman. In doing so, we will attempt to examine the direct effects children have on a mother’s lifelong earnings and how this factor contributes to the overall wage gap between men and women.
The Army Reserve Officer Training Corps (ROTC) program is the largest source of producing officers for the United States Army. Just as recruiters are needed for the enlisted side of things, recruiting is needed to find cadets that will eventually become officers. It is important that the program at UNLV maximizes its utility in finding which method of recruiting and which factors increase the likelihood of someone attending the program.

This study uses discrete choice econometric models such as the linear probability model (LPM), the logit and probit models to analyze factors that would affect an individual's decision to join the program. Data based on a survey of UNLV students will be used and include prior military service, family members in the service, the type of recruiting event used, gender and if they knew about the program before being recruited.
During recent years, electronic sports (esports) has become a major phenomenon, consequently betting on esports has become a prominent form of gambling online especially among younger bettors. However, there is still a paucity of knowledge on the demographic characteristics of this new cohort of gamers. Therefore, in the present study, past-year video gamers who had gambled at least once in the prior 12 months (N = 510) completed an online survey. Survey questions inquired about their gambling behaviors, including frequency of play, average expenditure, games played, and gambling-related problems (measured with the Brief Biosocial Gambling Screen), as well as esports spectatorship history and general demographic questions.

Esports bettors were a distinct cohort from their counterparts in this sample of video gamers, exhibiting; they gambled more frequently, spent more time per gambling session, had a higher likelihood of screening positive on the BBGS classification, and were more likely to have watched an esports event in the past year, when compared to other gamblers. Results here contribute to the growing body of research into the dynamic profile of esports gamblers by providing a background on the gambling behaviors of a video gaming population, and this study can also serve as a baseline profile of video gamers who gamble, helping to define comparisons in future studies of esports betting.
EXHIBIT F

FINE ARTS, LIBERAL ARTS, AND
URBAN AFFAIRS
PRESENTATIONS & EXHIBITS
Social categories (e.g., gender, race, sexual orientation) and associated stereotypes can result in systems that constrain an individual’s career trajectory, as well as societal progress. Undergraduates from underrepresented groups are more likely to be vulnerable to these social forces, which can be detrimental to their college experience and actualization as budding professionals. The current study aims to address these issues by investigating the career development experiences and needs of UNLV undergraduate psychology students from underserved groups (e.g., LGBTQ students, veterans, first-generation students, racially diverse students, students with mobility impairments, neurodiverse students, etc), as well as the needs of stakeholders (e.g., graduate students, faculty, university and campus staff) who commonly work to prepare such students for the workforce. In doing so, members of the Outreach Undergraduate Mentoring Program (OUMP), a student organization affiliated with the UNLV Psychology Department, are employing a participatory action research (PAR) study to understand and assess student and stakeholder experiences within the career development structures operating at UNLV. This collaborative process of discovery among the research team and individuals in the population under study, reveals psychology undergraduates’ immediate career development needs, while also developing OUMP members’ research acumen and workforce preparation. Findings provide preliminary insight into students’ career development challenges and suggest potential interventions within the UNLV community, while also contributing to the literature on higher education career readiness practices for undergraduates from underserved groups. Interventions may include methods to improve access to existing campus resources, dependent on results.
Since the establishment of a “25% recycling rate by the Nevada Legislature in 1991”, the Las Vegas Valley has undergone major innovations to improve recycling among single family homes (Laija, 2008). Curbside single-stream recycling, also known as comingled recycling, has increased the recycling participation rate by 400% (J. Walters, personal communication, February 19, 2019). The purpose of our study is to assess the differences in recycled material on a yearly basis, starting from 2008 when comingled recycling was implemented in the Las Vegas Valley. We used sources from Southern Nevada’s preferred provider, Republic Services of Southern Nevada, which manages the largest material recovery facility in North America and services the four municipalities of Las Vegas, North Las Vegas, Henderson, and unincorporated Clark County. We examine trends for multiple types of recyclables and municipal solid waste disposal from comingled recycling for Las Vegas Valley from the Southern Nevada Health District’s 2008-2017 ‘Annual Recycling Reports’. We compare when each municipality began implementing comingled recycling to these trends. We find an increase in amounts recycled for comingled recycling.

Acknowledgements:
We are grateful for the help we received on this project. Statements and views expressed here do not necessarily reflect those of UNLV or Republic Services.
Recent research regarding international non-governmental organizations (INGOs) that advocate for human rights strategically choose when and where to locate their operations. These operations include their physical offices, administrative functions, and professional staff. We focus on mobilization strategies including “top-down and “bottom-up” strategies.

These strategies are based upon a number of operational factors such as resource constraints, political efficacy, and practical concerns relating to employee safety and need of recipients. We extend this research by considering the effect the mass membership of these organizations have in the INGOs’ ultimate decision regarding location. We also consider additional characteristics of host states including regime type, alliance partnerships, and colonial legacy. Our findings show congruence with established research and has important policy implications for both practitioners and academia.

Funding for this project was provided by the 2018 Office of Undergraduate Research (OUR) SURF award.
Microaggressions can be subtle and often spewed with unintentional offensive comments or reinforcing a stereotype but, the behavioral, physiological, and psychological stress they place on people over time can have serious impacts on quality of life, physical, and mental health. This research examines the microaggressions that are specific to the intersections of being trans, and a person of color among other marginalized identities.

I will be conducting this by using autoethnography, and community-based participatory research (CBPR). The results of this will bring awareness to cisgender heterosexual (cishet) and cis queer folks engaging with TPOC to be more conscious of what is appropriate and what is not and will grant more open and honest dialogue to come up with the solutions to eliminate them from being said in the future. My analysis will also help those who are a part of the trans community to be able to recognize when microaggressions are said to them to have self-advocacy and the language to articulate the possible racist/transphobic comments that were said to them. This will decrease stress levels, increase comfortability, and get rid of negative stigmas of TPOC and can build stronger relationships for everyone.
Five and a half kilometers distant from the Caracol site epicenter lies an area known as “Monterey,” named after a Maya residential group in this vicinity that was dug in the 1990s; the name is now applied to the public architecture in this location and used for close-by residential groups. Archaeological investigations in the area of Monterey at the ancient Maya city of Caracol, Belize was carried out in 2019 by excavating multiple edifices that consisted of public buildings and residential groups. The research conducted was part of the 35th field season of the Caracol Archaeological Project led by Dr. Arlen Chase and Dr. Diane Chase along with a group of UNLV students and other experts. Three structures were investigated in the easternmost residential group at Monterey, nicknamed “Pebble:” a small eastern/central pyramid (C219B), a northern building (C219C) and a far eastern building (C219D). West of Pebble was the public architecture of Monterey (nicknamed “MPA”). Two areas were excavated: the first was a large hillside eastern pyramid (C220B); the second was the playing field for a Maya ballcourt (C220C). Further west of the public architecture lay another residential group, nicknamed “Boulder;” this plazuela group had its eastern building and supporting platform trenched to bedrock (C221B). The excavations produced interesting findings in architecture from all the buildings at Monterey. Some showed a long construction history while others represented single-phase constructions placed directly on bedrock. Recovered ceramic, lithic, and groundstone artifacts (including a stone ballcourt monument) were also an important part of being able to interpret the investigations in terms of the time period of occupation and the various construction efforts. The 2019 research demonstrated that Monterey was constructed and used from the Late Preclassic through the Terminal Classic Periods. Especially surprising was the amount of construction effort represented in these data at the time of the Maya collapse around C.E. 900, showing that the outlying population of Caracol was still thriving just before the city’s final abandonment.
Virtual Reality

Peter Hernandez (1), Si Jung Kim (2), & Abijith Prabhu (3)
(1) Department of Computer Science
(2) Entertainment Engineering and Design
(3) Department of Mechanical Engineering

Faculty Research Mentor: Si Jung Kim, Ph.D.
Entertainment Engineering and Design

Background: When a patient is under local anesthetic, they are kept conscious throughout the procedure unlike being put to sleep under general anesthetic. If a patient is still aware of the procedure there is still potential for them to register pain, especially if the patient is instructed to not make any movements throughout the procedure. Studies have shown that Virtual Reality (VR) programs have helped children and patients manage pain (Gold, Kant, Kim, & Rizzo, 2005)(Kim, Gold, Kant, Joseph, & Rizzo, 2006). The objective of this research is to investigate how different levels of VR fidelity affect patients’ perception in VR pain management.

Methodology
One method of stimulation that involves minimal movement from the patient involves using a virtual reality headset. The virtual reality headset will contain a program with a relaxing setting and a game to distract the patient. The project collaborates with a local medical firm called, LVMIS. The doctors working with LVIMS gives feedback after each new build of a program is built.

Prototype: The virtual reality headset is small and is composed of an Android cell phone with a Unity game loaded in and a Google Cardboard headset to hold the phone in. The Unity game consists of relaxing scenery with spheres of differing sizes and colors randomly placed around the user’s field of vision. The object of the game is for the user to make the spheres disappear by looking at them long enough.

Expected Results: This virtual reality headset provides the patient with an experience that not only relaxes them, but also keeps them distracted from any medical procedure they are going through.
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The Tipping Point

Holly Haywood
Department of Art

Faculty Research Mentor: Karen Harry, Ph.D.
Department of Art

The Tipping Point is a series of visual representations of individuals’ approach to food. Leading up to the creation, I surveyed 10 people on their connection to food through an informal conversation. From their experiences I created my interpretation of their relationship as a hand holding an ice cream cone (sample pictured below). For some their interaction with food is strictly for nourishment, being a single sable scoop on top of the cone, but for most food is a reflection of their daily struggles in life.

With this series, I am translating the everyday encounters of food to something visual and opening up a dialog with not only the participant, but with any viewer on how we can change our interactions with food and its connection to body image. The pieces will be displayed together in an exhibition in the Donna Beam Gallery at UNLV from May 3rd to the 31st.
How does one remove stigma from an identity? Stigmatization is a process that requires years of social construction. It is a process that has historically led to the discrimination of various communities. In my art practice, I seek to reduce discrimination towards women. My artwork depicts strong and empowered women in order to correct the stereotype of female weakness. Ultimately, my artistic goal is to improve the way in which women are perceived, and by extension, how they are treated. As an artist, I appreciate the relevance of art in shaping cultural values and practices. Accordingly, I look to other artists for guidance on how to make societal impact. This research project consists of an investigation and analysis of Amy Sherald’s artwork at the Contemporary Art Museum in St. Louis. Sherald creates portraits of black Americans she meets in her everyday life. She strives to tell staged narratives of constructed identities while increasing the representation of the black community, which is often underrepresented/misrepresented in the art world. She wants viewers to “imagine life outside of the circumscribed stereotype, or identity that can be controlled by many circumstances such as your environment, your parents, your friends, your skin color, your class, etc.” My investigation into Sherald’s art practice led to reconsideration in my own work, such as the exploration of new methods through which I might convey empowerment. Additionally, Sherald’s portraits increased my awareness of the importance of symbolism in relation to building narrative and identity.

This research was presented at the ArtExtraordinaire, August 2018 (art exhibition, Caeruleum, October 2018 (art exhibition), and Un Orgasmo d’Arte, March 2019 (art exhibition).

Funding for this project was provided by the 2018 Office of Undergraduate Research (OUR) SURF award.
Redefining Identity and Removing Stigma Through Representation in Painting

Zully Mejia  
Department of Art

Faculty Research Mentor: Alisha Kerlin  
Barrick Museum & College of Fine Arts

How does one remove stigma from an identity? Stigmatization is a process that requires years of social construction. It is a process that has historically led to the discrimination of various communities. In my art practice, I seek to reduce discrimination towards women. My artwork depicts strong and empowered women in order to correct the stereotype of female weakness. Ultimately, my artistic goal is to improve the way in which women are perceived, and by extension, how they are treated. As an artist, I appreciate the relevance of art in shaping cultural values and practices. Accordingly, I look to other artists for guidance on how to make societal impact. This research project consists of an investigation and analysis of Amy Sherald’s artwork at the Contemporary Art Museum in St. Louis. Sherald creates portraits of black Americans she meets in her everyday life. She strives to tell staged narratives of constructed identities while increasing the representation of the black community, which is often underrepresented/misrepresented in the art world. She wants viewers to “imagine life outside of the circumscribed stereotype, or identity that can be controlled by many circumstances such as your environment, your parents, your friends, your skin color, your class, etc.” My investigation into Sherald’s art practice led to reconsideration in my own work, such as the exploration of new methods through which I might convey empowerment. Additionally, Sherald’s portraits increased my awareness of the importance of symbolism in relation to building narrative and identity.

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Funding for this project was provided by the 2018 Office of Undergraduate Research (OUR) SURF award.
EXHIBIT G

HEALTH SCIENCES AND LIBERAL ARTS POSTER PRESENTATIONS
# VEGASSTRONGER: Investigating Mental-Health Treatment Disparities for UNLV Students Following Exposure to Traumatic or Violent Events

Eli Thompson (1), Wayne Boulton Jr. (2), & Carrera Slocumb (3)
(1) Department of History
(2) Department of Philosophy
(3) Department of Sociology

Faculty Research Mentor: Miriam Melton-Villanueva, Ph.D.
Department of History

The effects of violence on an individual’s mental health are well-evidenced, with research on its effect on a community expanding as focus on the impact of collective trauma grows. Like several universities, UNLV has on-campus counseling resources for students and faculty alike. This provides a space for campus community members to address their mental health concerns without having to travel very far; but in the wake of October 1 and with several indirect exposures to violent incidents on campus a year, are those efforts meeting their goals of service, safety, and efficiency? Though UNLV houses UNLV Counseling and Psychological Services (CAPS) and the CARE Hotline, there have been critiques on CAPS’s capacity to serve the student population in a timely matter, which is critical for maximum intervention efficiency for long-term treatment. Through conducting in-person community needs assessment surveys with students, staff, and faculty at UNLV, we anticipate illustrating a disparity in the barriers to access for treatment within our low-income student community, which literature shows frequently has negative impacts on student achievement.

By initiating a community partnership with UNLV Counseling and Psychological Services (CAPS), UNLV CSUN, and UNLV’s Psi Chi Registered Student Organization, we are actualizing our findings through advocating the appropriation of additional resources to the relevant services on campus, informing executive administration on the known barriers to access, and by sharing evidence-based referral network for overburdened mental-health services to ensure their safety and timely student treatment.

We hope to find other options that could be helpful to the student body that will impact the future of underserved UNLV Students.
SURVEYING COLLEGE STUDENTS ON ECO-TERRORISM

Itzel Rios (1), Cassandra Boyer (2), & Matthew West (2)
(1) Department of Political Science
(2) Department of Criminal Justice

Faculty Research Mentor: Emily Troshynski, Ph.D.
Department of Criminal Justice

While the perception of environmental and animal rights groups as extremist, high-risk domestic terrorism threats by law enforcement agencies and the government has been well documented (Amster, 2006; Carson, LaFree, & Dugan, 2012; Freilich, Chermak, & Simone, 2009; Glasser, 2011; McCoy, 2007; Salter, 2011; Smith, 2008; Sorenson, 2009), less has been said about the views of these groups among members of the public. To address this gap in the literature, the current research will survey college students taking an introductory criminal justice course to learn about their perceptions on:

1) the legality of actions that animal rights activist take;
2) perceptions on how direct actions taken by animal rights groups are classified; and
3) whether there are discernible differences in the way students view comparable instances of direct actions taken by social movements.

Students were also surveyed on their views regarding eco-terrorism laws, ag-gag laws, and laws pertaining to Green movements in general (environmental and animal rights groups). This presentation will elaborate on the findings of this exploratory research.
Suicide was the second leading cause of death among school-aged children and young adults in the United States in 2017. This study examines racial differences in suicide rates and methods among school-aged youth and young adults in America.

Methods: Analyses included suicide mortality data during 2008-2017 from the Multiple Cause of Death from the CDC’s National Center for Health Statistics WONDER database. Suicide deaths were identified from the underlying causes of death using ICD-10 codes. Age-adjusted death rates were calculated. School-aged children and young adults were grouped into age categories: 5-14, 15-24, 25-34 years. Percent change in suicide rates were contrasted between 2008 and 2017, which were also examined within and between racial groups. Top suicide methods were also identified. All rates were calculated per 100,000 population.

Results: Suicide rates increased by 42% from 2008 to 2017, with the biggest increases seen among youth ages 5-14 years (160%). Although suicide rates were lowest among Asian/Pacific Islanders (API) and Hispanics, they experienced the highest suicide rate increases across racial groups (68% and 63%, respectively). In 2017, American Indians/Alaska Natives (AIAN) had the highest suicide age-adjusted rate (27.8), with a rate of 53.7 for AIAN males ages 15-24. For suicide methods, suffocation was highest for AIAN, API, and Hispanics, while firearms were highest among African Americans and Whites.

Conclusion: Differences in suicide rates and methods across racial subgroups suggest the need for tailored intervention strategies to identify risk factors and refer school-aged youth and young adults to preventive services.
Background: Suicide ranks within the top fifteen causes of death among adults 55 and older in the United States and is a growing concern in the face of social isolation and other end-of-life issues. This study examined differences and trends in suicide rates and methods among older adults in the U.S.

Methods: Suicide mortality rates from 2008-2017 were derived from the Multiple Cause of Death files in the CDC’s WONDER database. Suicide deaths were identified from the underlying causes of death using ICD-10 codes. Age-adjusted death rates (per 100,000) were calculated. Older adults were grouped into four age categories: 55-64, 65-74, 75-84, and 85+ years. Percent change in suicide rates between 2008-2017 were examined, which were then stratified by gender and top suicide methods.

Results: Suicide rates increased by 16% among adults 55 years of age and older from 2008 to 2017 (15.4 vs 17.8 per 100,000 respectively). In 2017, the suicide rate among older adults was 27% higher than the general population (14.0 per 100,000). Suicide rates were significantly higher among men relative to women for those ages 85+ (14:1 ratio of males-to-females). However, females in the 65-74 age group experienced the highest increase of suicide rate (41%) compared to other females or males across age groups. The most common method of suicide was firearms, followed by poisoning and suffocation. Suffocation had the highest increase over time (37%).

Conclusion: Rising suicide rates among older adults suggest the need for tailored intervention strategies that address upstream suicide-related risk factors.
Tell Abraq is an Umm-an Nar site located in the modern United Arab Emirates. This site features a Late Bronze Age tomb that was utilized for roughly 100-150 years during Tell Abraq’s occupation. The tomb at Tell Abraq holds the extensively commingled remains of men, women, and children, giving a minimum number of 406 individuals within its confines. Among the many individuals in this tomb was an individual with achondroplastic dwarfism. The study of this individual involved the forensic and medical analysis of their complete right radius, an incomplete left radius, a partial right ulna, and a partial right medial clavicle. The intact right radius measured, at maximum, only 13.1 centimeters, in stark contrast to the average maximum length of a radius, which is between 22.0 cm and 24.6 cm (Mall et al., 2001). There is a marked difference in size that is clear across all of the available elements, pointing to a short stature condition. The morphology of these elements, including the presence of a bilateral deformation of the radial head, the misshapen trochlear notch of the ulna, and the flared, robust appearance of each element are compatible with clinical literature about the radiographic diagnostic characteristics of a form of short stature known as achondroplasia. Indications of repetitive use, such as cupping present on the medial clavicle, point to long term continued use of this individual’s arms. Despite having achondroplasia, this individual seems to have been able to perform some degree of work using their arms.
Dogs are ubiquitous in our culture, particularly within our social and personal lives. Although anthrozoology (the study of human-animal interactions) is an expanding field, few studies have observed the effects of certain characteristics on the way owners interact with their dogs. The purpose of this study is to witness how humans and dogs interact in a "natural" setting through the observation of pet dogs at leashed and off-leash dog parks across Las Vegas. We utilized 10-minute focal follows to determine if gender or generational influences affect the interplay between human-dog dyads in this setting. For each interaction, we recorded time of day, day of week, age group, gender of both human and dog, type of park, if the dog was leashed or unleashed, and the presence of other dogs or people affiliated with the observed dyad. We also documented specific interactions such as: pets dog on head, pets on rear, verbal calls, baby talk, whispers, hug, kisses, toy throwing/playing, scolds, hits/spanks, collar corrections, or leashing of dog. To date, we recorded over 150 follows. Preliminary data suggest that women are more verbal with their dogs compared to men (p=.013). Initial observations also show that women are more likely to whisper or speak gently to their dogs (p=.04). These differences are consistent with evolutionary theory and the growing research on pet parenting. Many people consider their dogs family instead of "just pets;" therefore, investigating these interactions is fundamental for future anthrozoological research. (Keywords: dogs, pet dogs, dog park, gender, age, human-animal interactions)
In 2016, 39.8% of US adults and 18.5% of US youth are considered obese. (1) The Hcg diet has gained popularity in combatting obesity. The theory of using Hcg with a low calorie diet was that it would have an effect on satiety as well as stimulating the body to use nonstructural fat for energy use. (2) Limited studies were found that evaluate the effectiveness of a 500-calorie diet with and without Hcg supplementation. These studies show no difference between low calorie diets with or without the addition of Hcg on weight loss and body composition; however, there were no measurements to compare satiety levels. (3,4) The purpose of this literature review is to identify information to support a study to test the hypothesis that a 500-calorie diet with Hcg supplements will improve satiety levels more than a 500-calorie diet without supplementation.

The benefits of being physically active include lower risk for developing chronic illness conditions, improved mood, and better sleep quality. Being involved in the physical activity program may also improve self-esteem and body image in youths (Cataldo et al., 2013). However, with the growing absence of PE in school, physical activity involvement has dramatically declined among school students. Furthermore, the amount of physical activity done by girls tends to be lower compared to that of boys during adolescence, and the disparity persists through adulthood (CDC, 2018). Several reported perceived barriers to participating in physical activity among teenage girls included: feeling incompetent, “girls” school uniform (Watson, Eliott, & Mehta, 2015), peer-influence, competition, concern about safety (Dwyer et al., 2006), appearance concern (Standiford, 2013), and gender norms (Spencer, Rehman, & Kirk, 2015). Therefore, teenage girls may need additional support to maintain health-enhancing physical activity.
Introduction: Few studies have investigated the effect of cerebellar transcranial direct current stimulation (c-tDCS) on learning multi-joint motor tasks. This study examined the effects of single-session c-tDCS on total, online, and offline learning of an overhand throwing task. We hypothesized a significantly greater total, online, and offline learning effects in the c-tDCS group compared to SHAM group.

Methods: Investigation was a double-blind, two-session, SHAM controlled design. Twenty-one young, healthy, and right-handed participants gave informed consent and were randomized either c-tDCS (N=6) or SHAM (N=7) group. Andoal c-tDCS was applied over the right cerebellum during the throwing task. The c-tDCS group received 20-minutes of 2mA online stimulation during practice blocks, and the SHAM group received fake stimulation. Two experimental sessions were completed, consisted of 1) baseline-test block, 2) five practice blocks, 3) 5-minute post-test block, 4) 24-hour retention block. In each block, ten throws were performed with a chalked tennis ball at a target that was 6-meters away. Motor performance for each block was calculated as the mean-endpoint error. The dependent variable was used to quantify learning effect was the percent change in endpoint error. Independent t-tests were used to detect total online learning effects, and offline learning between groups.

Results: Online learning between-groups approached statistical significance (p = 0.06). However, total learning (p = 0.21) and offline learning (p = 0.49) were not significantly different.

Conclusions: Findings indicate that c-tDCS may improve online learning of a multi-joint throwing task. Additional research participants are needed to more robustly test our hypothesis.
The timing of pubertal onset has been associated with a number of disordered eating symptoms (e.g., body dissatisfaction, dieting); however, few studies have explored whether differences in pubertal timing predict differences in Drive for Muscularity (DM) – a form of body disturbance that is particularly evident in males. Moreover, in males, pubertal maturation results in decreases in body fat and increases in muscle mass, which moves boys closer to the socially-prescribed muscular body-ideal. Boys who mature later than peers may be at heightened risk for DM, relative to their peers, given their delay in physical/masculine maturation. This study examined whether later pubertal onset is predictive of greater DM in 272 young adult men. The Retrospective-Pubertal Development Scale assessed perceived (i.e., perception of timing compared to peers) and objective (i.e., age at onset of secondary sex characteristics) reports of pubertal timing on voice changes, body hair, and spontaneous erections. The Drive for Muscularity Scale assessed behavioral and cognitive aspects of DM. Later pubertal timing showed somewhat stronger predictive effects on behavioral aspects of muscle-building than on cognitive aspects, independent of BMI. In addition, more robust effects were detected using objective measures of pubertal timing than perceived timing. These findings highlight the importance of differentiating perceived versus objective measures of pubertal timing and provide evidence that later pubertal timing may exhibit differential effects on various types of DM symptoms. Future studies should empirically identify the explanatory factors (e.g., internalization of the muscular body-ideal) underlying later pubertal timing effects on risk for DM behaviors.

This research was presented at the CAEO’s 19th Annual Undergraduate Research Symposium, UNLV Spring 2018 Conference, and 2018 Diversity Research and Mentorship Reception.

Funding for this research was provided by LSAMP.
The United States market for prescription testosterone has exploded in value within the last two decades due to widespread androgen deficiency, direct-to-consumer advertising, and presubscribed notions of testosterone effects. However, few studies have directed inquiry to the patients on testosterone replacement therapy. The current study explores U.S. adult male patient’s motivation for taking androgen therapy and their reaction to therapy through online surveys. We focus on the reasoning for taking prescription testosterone and any changes experienced since then. Responses will be in a form of open-ended questions that will use a coding scheme based on medicine, male life history theory, and behavioral endocrinology approaches. We found that the five most frequent reasons for men to take testosterone replacement therapy were characterized by low testosterone (37.1%), well-being (35.2%), energy (28.7%), libido (21.9%), and social energy (19.4%). We also noticed a trend that older men cites libido as a motivator for testosterone therapy more frequently than younger men. Men reported that therapy improved their energy (52.3%), libido (41.9%), and muscle (28.5%). Data is interpreted in the context of medicine, life history theory, and behavioral endocrinology disciplines with an emphasis on sex and energy.
Males make up one-third to one-tenth of eating disorder cases; however, less than one percent of eating disorder research targets male presentations. Although little is known about the risk factors that contribute to eating disorders in males, previous research has shown that biological risk factors, such as low levels of testosterone, enhance risk for disordered eating. In addition, psychosocial factors, including weight-based teasing, have been shown to be predictive of maladaptive eating. However, little work has been done to investigate the interplay of these biological-environmental risk factors. The proposed project intends to examine weight-based teasing as a factor that might interact with testosterone levels to predict differences in risk for disordered eating (DE) in early-to-late pubertal boys (N = 98, age = 10-15 years) using archival data from the Michigan State University Twin Registry. It is hypothesized that boys with lower levels of testosterone and higher levels of weight-related teasing will show the highest levels of DE, while boys with average-to-high testosterone and minimal endorsement of weight-based teasing are expected to be at low risk for disordered eating. This study would be the first to assess the interplay between biological and psychosocial variables within the framework of developmental and sex-specific processes.

Funding for this research was provided by the McNair Scholars Institute.
College athletes evidence mental health difficulties at rates similar to or higher than non-athlete populations, but there is no current standardized measure sensitive to sport and capable of capturing student-athletes’ mental health concerns. The present study aimed to validate a sport-specific screening measure to facilitate mental health referrals to appropriate treatment. Participants were 289 student-athletes who completed measures evaluating global mental health symptoms (SCL-90-R Global Severity Index, GSI), factors that interfere with sport performance in training (Problems in Sport Training Scale, PSTS) and competition (Problems in Sport Competition Scale, PSCS), and desire for sport psychology services (DSPS). Results from three hierarchical multiple regressions determined that all three SIC domains (PSTS, PSCS, and DSPS) were predictive of mental health concerns. Receiver operating characteristic (ROC) analyses were utilized to determine if the PSTS, PSCS, and DSPS could be useful for identifying athletes’ at-risk for mental health concerns due to sport-specific problems. ROC analyses indicated that all three SIC domains classified high-risk athletes (those with a SCL-90-R GSI T-score > 60) significantly better than chance classification with area under the curve (AUCs) of .64 -.74. These results indicate that this may be an appropriate screening measure to identify college athletes who might benefit from further evaluation of mental health concerns and referral for intervention.

This research was presented at the American Psychological Association 2018 Conference.

Funding for this research was provided by the Office of Undergraduate Research and the UNLV Department of Psychology.
Gender Differences in Trauma Type and PTSD Symptomatology in Maltreated Youth

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More than two-thirds of children report experiencing at least one traumatic event by the age of 16 (Copeland, et. Al, 2007). Researchers found females report more posttraumatic stress disorder (PTSD) symptoms than males (Brosky & Lally 2004). The current study utilized the Children’s Depression Inventory (CDI; Kovacs, 1998) to test gender differences in the report of trauma type and symptoms in youth who have experienced trauma. Participants included 377 youth who were removed from their homes following a child maltreatment report. An Analysis of Variance showed a significant gender difference between males and females who reported sexual abuse or violation, and witnessing violence, such that female youth reported experiencing more traumas. Total scores on the CDI revealed a significant difference between genders on specific subscales. The results of this study suggest there is a higher prevalence of sexual abuse, sexual violation, and witness to violence among female maltreated youth. Our study also suggests that girls who have experienced maltreatment trauma are more likely to exhibit symptoms of negative mood, negative self-esteem, and anhedonia. The present findings suggest important implications for further research regarding the specific risk factors placing females at higher risk for developing negative symptomatology associated with PTSD. It also aids with personalizing treatments between the two genders by shedding light on important differences in the presentation of internalizing symptoms.

Funding for the project was provided by the Office of Undergraduate Research (OUR).
Infant research plays an important role in forming developmental theories. Replicability of a study is critical in providing the basis for these theories. However, there are many constraints within infant research, such as small sample sizes or limited methods of measurement, that shape the replicability of a study. The Many Babies project aims to address these issues by working collaboratively with labs across the world through investigating the established theory of infant’s preference of infant directed speech (IDS) over adult directed speech (ADS). As a part of the Many Babies project, our research lab conducted two experiments. In Experiment 1, we investigated infant’s preference for IDS or ADS. Our lab collected data from 3- to 6- month-old infants and found a significant preference for IDS over ADS, which replicates prior research. In Experiment 2, we are participating in a Many Babies follow-up study to Experiment 1, which investigates whether preference for IDS is related to the infants’ later language development through a longitudinal study. Families complete the MacArthur Bates Communicative Development Inventory (MB-CDI) when the infant is 18-months-olds and 24-months-old, indicating what words their child knows or understands. We hypothesize that infants who showed a strong preference for IDS speech will also show stronger language development at these two timepoints in Experiment 2. Pilot data will be discussed. Overall, these findings will provide insight into the relationship between IDS preference in infants and language development, while contributing to the literature of replicability in infant research.
Imagine standing in a store, making a mental note of five items to purchase. You stop and talk to a friend and you still remember three of those items. The ability to hold information (items to purchase) while processing distractions (your friend) is handled by the working memory (WM) system. The current set of studies explores the mechanisms involved with forgetting in WM (inhibition vs decay). To investigate forgetting, participants were presented with words to be remembered in red (i.e., targets) and words to be forgotten in black (i.e., distractors). The primary manipulation in this task was the amount of free-time available after viewing a distractor, either short (0.2 seconds) or long (1.5 seconds), with total time held constant across trial conditions. In Experiment 1, participants were tested with a recognition test—selecting target words from a matrix of words. In Experiment 2, participants did a recall test—typing in the target words they remembered. Our main measure was the number of distractors mistakenly remembered in each of the free-time conditions as a means of comparing the two theories of forgetting. In Experiment 1, we found participants recognized fewer distractor words in the long trials as compared to the short trials, which supports an inhibition account. In Experiment 2, we found no difference in the number of distractors recalled in the different conditions, which supports decay. Overall, our results show that the type of test being used can change which mechanism appears to be playing a role in WM forgetting.
Neuroinflammation is a complex and vital biological response in the CNS. Native immune cells known as microglia protect the CNS from toxins, pathogens, and injuries. They undergo conformational change upon detecting abnormalities, shifting to an activated state. In addition, they release pro- and anti-inflammatory cytokines necessary in response to infection or trauma. Previous studies indicated that chronic inflammation exacerbates neurodegenerative diseases such as Alzheimer’s Disease (AD) and Multiple Sclerosis. Also, it affects microglial survival, function and neuro-signaling.

γ-aminobutyric acid B (GABAB) receptors are metabotropic transmembrane G protein-coupled receptors (GPCR) that bind to GABA, the main inhibitory neurotransmitter in the CNS. They are present on the surface of microglia. Several studies demonstrated that chronic inflammation results in a significant GABAB receptor loss. We hypothesize that the administration of a receptor agonist will alleviate the negative impacts of chronic inflammation to GABAB receptors. The aim of this study is to investigate the potential of Baclofen to arrest and/or recover the decreasing GABAB receptor levels during inflammation, and its potential to reduce inflammation in general.

We incubated a microglia cell line, BV2, with an inflammatory agent, polyI:C for six hours. Thereafter, the cell-culture was incubated with Baclofen for 24 hours. Cells were collected and processed for Western Blot and Real-Time PCR. We observed changes in GABAB receptors both in protein and mRNA levels. We suggest that the potential of Baclofen should be further investigated on AD-related mouse models in vivo or primary cell culture system.
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EXHIBIT I

SCIENCE AND ENGINEERING POSTER PRESENTATIONS
Sarcomas are a diverse group of cancers that lack effective therapies. Despite their numerous metabolic differences, argininosuccinate synthetase (ASS1), the rate-limiting enzyme in the synthesis of arginine, is downregulated in almost 90% of sarcomas (Bean et al., 2016). By selectively depleting arginine in tumor cells, growth stagnation in ASS1-deficient sarcomas can be achieved. PEGylated arginine deiminase (ADI-PEG20) is an enzyme that breaks down external-source arginine, and thus specifically targets ASS1-deficient tumor cells. However, most sarcomas re-express ASS1 and become resistant to ADI-PEG20 treatment. To study the kinetics and heterogeneity of ADI-PEG20 resistance development in vitro, a translationally regulated sensor of intracellular arginine levels has been developed, which is used as a direct measure of resistance to ADI-PEG20. A variation of the arginine sensor with Renilla luciferase as the bioluminescent reporter was constructed and integrated into sarcoma cell lines. The kinetics of ADI resistance development were measured as luciferase expression over time. Results have shown that different sarcomas display varying kinetics of ADI-PEG20 resistance development, ranging from 2 days to a week. Heterogeneity was determined using fluorescence variation in individual sarcoma cells using the mApple arginine sensor construct. ADI-PEG20 resistance developed homogeneously in all the studied cell lines. Given that sarcoma cells respond synchronously to ADI-PEG20, knowing the kinetics of ADI-PEG20 resistance development can help optimize timing of combination drug delivery treatments to sarcoma patients.

This research was presented at the Washington University Summer 2018 Research Symposium where it was awarded Best Poster, and at the 2018 Annual Biomedical Research Conference for Minority Students where it was awarded an outstanding presentation Certificate of Achievement.

Funding for this research was provided by the 2018 Amgen Scholars Program.
Sarcomas are a diverse group of cancers that lack effective therapies. Despite their numerous metabolic differences, argininosuccinate synthetase (ASS1), the rate limiting enzyme in the synthesis of arginine, is downregulated in almost 90% of sarcomas (Bean et al., 2016). By selectively depleting arginine in tumor cells, growth stagnation in ASS1-deficient sarcomas can be achieved. PEGylated arginine deiminase (ADI-PEG20) is an enzyme that breaks down external-source arginine, and thus specifically targets ASS1-deficient tumor cells. However, most sarcomas re-express ASS1 and become resistant to ADI-PEG20 treatment. To study the kinetics and heterogeneity of ADI-PEG20 resistance development in vitro, a translationally regulated sensor of intracellular arginine levels has been developed, which is used as a direct measure of resistance to ADI-PEG20. A variation of the arginine sensor with Renilla luciferase as the bioluminescent reporter was constructed and integrated into sarcoma cell lines. The kinetics of ADI resistance development were measured as luciferase expression over time. Results have shown that different sarcomas display varying kinetics of ADI-PEG20 resistance development, ranging from 2 days to a week. Heterogeneity was determined using fluorescence variation in individual sarcoma cells using the mApple arginine sensor construct. ADI-PEG20 resistance developed homogeneously in all the studied cell lines. Given that sarcoma cells respond synchronously to ADI-PEG20, knowing the kinetics of ADI-PEG20 resistance development can help optimize timing of combination drug delivery treatments to sarcoma patients.

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Evolution of the WRKY Transcription Factors Across Oryza

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By 2030, United Nations projects the world population to reach a staggering 8.5 billion and up to 9.7 billion in 2050. However, agricultural land is expected to shrink from the growth of living space and climate change. In order to accommodate for the foreseeable future, studies must be conducted to elucidate the mechanisms by which plants adapt and flourish. Among the regulators of these mechanisms, the WRKY superfamily are transcription factors (TF) that regulate many vital abiotic and biotic stress responses. A bioinformatics approach was utilized to elucidate the WRKY family trends and evolution within Oryza. Furthermore, the study aims to identify unique WRKY genes of interest for future in-depth studies. The study identified 1018 WRKY genes across 9 species (11 genomes) using HMMER3.2b2. WRKY genes were characterized according to orthology and WRKY Group. We used bidirectional BLASTp to determine orthologous WRKY genes across our species. WRKY Groups were identified by based on conserved motifs for each WRKY classification. A phylogenetic model was built using MUSCLE for alignment in MEGA7.0 and maximum-likelihood with RAxML. WRKY genes were also mapped and depicted on chromosomal syntenies to show distribution. The study has successfully characterized the WRKY family in Oryza and investigated differences between the related species’ WRKY families. Our study was also able to explore the evolution of the WRKY family within Oryza and highlight unique WRKY genes. The novel information provides guidance for future functional studies that investigate WRKY TFs within Oryza.

Funding for this project was provided by the Nevada INBRE Program.
Honeybees (Apis mellifera) are a keystone species and serve as key pollinators for commercial crops. Paenibacillus larvae is a gram-positive bacterium that is the causative agent of American Foulbrood (AFB), the most destructive bacterial disease affecting the honeybee. As antibiotic-resistant P. larvae strains are now widespread, there is growing interest in phages that infect P. larvae as an alternative treatment. A large number of P. larvae phages have been isolated and sequenced, but the precise mechanisms by which P. larvae phages lyse their host remain unclear. Tailed phages typically lyse their host by means of a holin/amidase cassette consisting of a hydrophobic holin protein that punctures the host’s inner plasma membrane and a hydrophilic amidase that cleaves the host peptidoglycan wall. A conserved N-acetylmuramoyl-L-alanine amidase has been conclusively identified in all sequenced P. larvae phage genomes and its function has been verified in experiments. On the other hand, a holin has not yet been conclusively identified, due to the fact that holins are poorly conserved and difficult to identify bioinformatically. Using the strongly lytic P. larvae bacteriophage Willow as a model organism, we have identified two genes, gp20 and gp22, as putative holins. The two genes are currently being experimentally tested to identify whether their bioinformatic functional assignment as putative holin genes is physiologically correct. Edited phage genomes where these genes have been knocked out alone and in combination are in the process of being generated, and the edited phages will be tested for lytic ability.
Sex Effects On Disease Severity In The Hamster Clostridioides [Clostridium] difficile Infection Model

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Clostridioides [Clostridium] difficile is a rod-shaped gram-positive bacterium that can exist in a vegetative or spore form. Particularly, the spore form of C. difficile can survive extreme environments such as high temperatures, harsh chemicals, antibiotics, and exposure to ultraviolet light. Because C. difficile spores are resistant, they can remain in the gastrointestinal tract of patients and cause severe diarrhea once they germinate into toxin-producing cells. In recent years, Clostridioides difficile infection (CDI) is becoming increasingly common and has exhibited a rise in severity due to emerging hypervirulent strains. Several studies have shown that sex can play a role in other intestinal disease such as inflammatory bowel disease (IBD) and Crohn’s disease. Estrogen has also been suggested to play a role in mediating gut inflammatory response and modifying intestinal permeability. Previously, we have shown that steroid hormones can affect C. difficile spore germination. Therefore, it is possible that female susceptibility to CDI may be unlike their male counterparts and a possible cause for variation. The hamster model has been traditionally used to study CDI. Hamsters are highly susceptible to CDI and can reach moribund rapidly. In this study, male and female hamsters were infected with type strain 630 spores. Animals were monitored for CDI signs throughout the duration of the study. Our observations show that female hamsters survive longer than their male counterparts even under bile salt analog prophylactic treatment. This analysis encourages us to further examine sex differences and their possible effects on CDI severity.

This project was funded by the National Institutes of Health (NIH).
Arctomecon californica is a critically endangered native plant species to southern Nevada and the surrounding Mojave Desert. With incredibly specific habitat comprised of gypsum rich soils coupled with a short lifespan and a heavy reliance on soil seed banks, A. californica naturally is a difficult species. Problematic setbacks for the species such as habitat destruction and drought only add to the decline of A. californica populations. Although the species is protected by the Endangered Species Act in the state of Nevada, in a laboratory setting not much is known about the germination or treatment of A. californica. With minimal research history of the species, there is no protocol of how to successfully germinate A. californica in a laboratory situation. This project's goal is to take on A. californica by attempting to replicate the beginning stages of its natural growth cycle in the hopes of obtaining results of germination.
Despite the fact that soil seed banks are of ecological importance, it results difficult to quantify and accurately assess soil seed banks in a simple and reliable way. Methods such as emergence and extraction are inadequately acknowledged for desert ecosystems. Therefore, priority should rely on understanding the complexity of desert soil seed banks and on evaluating any long term changes. Thus, research will be done to determine seed and species presence as well as estimating their abundance present in soil. Through processes such as sieving and flotation, soil samples will be further divided into subsamples to test for presence of seeds in soil samples. Identification is crucial for matching seeds with plant species to evaluate any significant changes occurring over time.

Long-term Monitoring of Seed Banks, Fertile Islands, and Rare Gypsum Communities in Eastern Mojave Desert by Method of Extraction

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Nuclear reactors are an essential high energy source for various applications. Modeling nuclear reactors and using simulations are necessary because of the risk and cost of actual nuclear reactor cores. Monte Carlo simulations are the most accurate representation of nuclear reactor cores but can be computationally intensive. We propose the use of fission matrix methodology in simulations. A fission matrix represents the rate of fission neutron production in a reactor core, where the entry of the matrix is equal to the neutrons produced in, per neutron born from . This produces a matrix, where n is equal to the number of cells investigated. The power source distribution is given by the principle eigenvector and the for the reactivity of the core correlated to the principle eigenvalue. Given a varied temperature distribution for a core, a new fission matrix can be obtained by interpolating from a database of pre-calculated fission matrices at various uniform temperatures and parameters. This approach shows promise in accurately, and quickly, calculating fission source distributions and their corresponding temperature distributions. The largest resulting relative error of the calculated power distribution per pin was 1.77%. The greatest achievement is in speed. The Monte Carlo simulation would require almost a thousand CPU hours, whereas the fission matrix methodology accomplished the same task, with minimum errors, in less than seven seconds. Future work would be to implement correction factors for neighboring temperature differences in three-dimensional models and investigate ways to decrease database size.

Funding for this research was provided by Toshiba-Westinghouse Undergraduate Fellows Program.
This experiment will determine the effectiveness of using zero valent iron (ZVI) to remove harmful oxyanions from contaminated groundwater. When the contaminated groundwater is exposed to ZVI, the contaminants in the water are reduced. To achieve this result, the contaminated groundwater will be directly mixed with either ZVI, a carbon source plus nutrients, or both, and the resulting solutions will be tested for contaminant concentration, as well as pH and iron ( ) concentration. The end goal of this experiment is to produce groundwater that contains little to no trace of the previously identified contaminants.
The groundwater at a specific well site is contaminated with perchlorate, chlorate, and nitrate. The goal of this experiment is to reduce these contaminants in the groundwater, thus making the groundwater safe for consumption. To accomplish this, the groundwater is first mixed with a carbon source and varying amounts of organics and is then fed through columns containing zero-valent iron (ZVI) and layers of soil. The combination of a carbon source, organics, and ZVI allows for bioremediation to occur within the contaminated groundwater, which is a process that reduces contaminants to their catatonic forms, making the groundwater safe for consumption. The experiment consisted of five columns, each with varying amounts of organics. One of the five columns contained a Peroxychem permeable reactive barrier, which was hypothesized to facilitate the oxidation process necessary for bioremediation. The results of this experiment show that the ZVI effectively reduced all of the aforementioned contaminants from the groundwater in all of the columns. The quickest reduction of contaminants was observed in the column containing the Peroxychem permeable reactive barrier, which supports the initial hypothesis. These results suggest that bioremediation in general is a viable method to reduce perchlorate, chlorate, and nitrate in contaminated groundwater, and Peroxychem permeable reactive barriers significantly expedite this process.

Investigation of Perchlorate and Co-contaminant Reduction Using Zero Valent Iron

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