UNLV
STUDENT
UNION

SUMMER 2019
UNDERGRADUATE
RESEARCH
SYMPOSIUM

EVENT PROGRAM & ABSTRACTS

IN PROUD COLLABORATION WITH
UNLV HONORS COLLEGE
& UNLV CSUN

WEDNESDAY
AUGUST 7 2019
11:30 AM TO 2:00 PM
10:30 - 11:30 AM  Check-in

11:30 - 12:15 PM  Opening Remarks & Lunch

Dr. Mary Croughan, Vice President for Research and Economic Development

Dr. Lisa Menegatos, Associate Dean of the Honors College

12:15 - 1:45 PM  Presentation Sessions

Room 207: Hospitality and Sciences Lightning Talks

Room 209: Business, Liberal Arts, and Urban Affairs Lightning Talks

Room 208: All Poster Presentations

1:45 - 2:00 PM  Closing Remarks

Dr. Levent Atici, Executive Director of Undergraduate Research
SESSION A

HOSPITALITY AND SCIENCES LIGHTNING TALK PRESENTATIONS
Anxiolytic Effects of Diphenhydramine Injected Mice

Jorge Carrera (1), Rochelle Hines (2), & Dustin Hines (2)
(1) School of Life Sciences
(2) Department of Psychology

Faculty Research Mentor: Dustin Hines, Ph.D.
Department of Psychology

The brain modulates arousal levels through inhibitory signaling. Without inhibition, hyper-arousal states can occur that may lead to anxiety, panic attacks, and the potential for forming Generalized Anxiety Disorder (GAD). Anxiolytic drugs act on γ-aminobutyric acid (GABA) neurons to induce the firing of inhibitory signals to reduce anxiety; however, typical anxiolytic drugs reduce arousal level excessively leading to sedation, coma, or death, and certain classes of drug can lead to addiction. Antihistamines have been shown in the literature to act on GABA and lead to decreased arousal states without sedation. Here, we show the effect of the antihistamine and mild-sedative, diphenhydramine, which acts on GABA to inhibit the activity of the tuberomammillary nucleus (TMN) leading to decreased release of histamine, a molecule responsible for inducing arousal in the brain.

We ran pre- and post-diphenhydramine injected wildtype mice in the elevated-plus maze as a behavior assay for anxiety and electroencephalography (EEG) to measure brain waveforms for changes in arousal. We show that diphenhydramine has mild-anxiolytic and mild-sedative effects without inducing sedation or leading to addiction, which are the common side effects of benzodiazepines and other anxiolytics. The results show the potential for diphenhydramine as an anxiolytic without the more severe side effects of other anxiolytics in the market.
Many of us work for a living, and many of us are afraid of losing our jobs to robots. What I've found is if you don't want to be replaced by a robot, you have to be better than a robot, and the key to being better than a robot is to develop the following four qualities: critical thinking, persuasion, solving problems across disciplines, and knowing your audience. I study casino gaming in the hotel college. From my research into Building a Better Hospitality Robot, the ideal robot platform will need to be online almost all the time, to help our guests engage in high value behavior: spending money and time, and visiting often. From the perspective of a customer, the customer-facing agents, be they human or robot, need to abide by Dacher Keltner's research into human relations, what makes people like other people: If you're enthusiastic, you're open to new ideas, you listen really well, you express gratitude and you share resources, really simple strategies, you rise in the ranks in just about every context that's been studied. We know some of the qualities that make people better than robots, and we know some of the qualities that make people like other people. These two data sets can inform us on how to create a better robot system for the hospitality industry.
Esports Environment

Rolando Corley Melton (1) & Brett Abarbanel (2)
(1) William F. Harrah College of Hospitality
(2) International Gaming Institute

Faculty Research Mentor: Brett Abarbanel
International Gaming Institute

This abstract is a submission for the 2019 Summer Undergraduate Research Symposium on Wednesday August 7th, 2019. The lightning talk is covering: an environmental scan research report on the complex topic of esports gambling, including a content analysis with a focus on gambling industry investors interested in learning more about the nuances of video game wagering. Types of gambling, video game companies involved in gambling, use of cryptocurrency, and the inlying scandals are all detailed in an environmental scan report covering esports. Market research, academic literature, and industry publications surrounding esports gambling is reported on, including the availability and participation of said gambling. Websites for different products are being cited, including additional insights from other video game activities synthesized in one place, with information that could be key for the future of the gambling industry being held in this environmental scan report. These research methods are assisted by Dr. Brett Abarbanel, Director of Research: UNLV International Gaming Institute. The intent of this report is bringing detailed information regarding esports gambling to UNLV academia and its surrounding community, where gambling and hospitality investors want a share of international and local esports’ economic upswing. This scan reveals a breakdown of the history of esports gambling; the current companies and consumers involved, as well as where top growth verticals in the sector lie.
Springsnails are a broad assemblage of freshwater snails, with the genus Pyrgulopsis containing 139 species distributed across western North America. Many species have extremely narrow distributions, existing in a single spring or spring system. Three species of springsnail occupy Blue Point Spring in Lake Mead National Recreation Area, including a species of conservation concern, the endemic Blue Point pyrg. Monitoring efforts have failed to detect this species at times, but it appears to be currently abundant. Our research focused on elucidating key ecological details about this species (i.e. distribution, abundance, and habitat associations). To assess these factors, however, we needed to differentiate among the springsnails in the system by species. Springsnails are very similar in appearance and miniscule in size; adults are less than 2 mm in length (1/13th of an inch). Given the need to distinguish the identity of tens of thousands of individuals sampled in this project, examining shell morphology (shape) under magnification appeared to be the only feasible approach. To confirm the accuracy of our species identifications, we developed a genetic assessment based on mitochondrial DNA (mtDNA). This assessment involved development of protocols to extract DNA from individual springsnails, amplifying a target gene using polymerase chain reaction, followed by sequencing. We targeted the cytochrome c oxidase subunit I gene because of the availability of representative sequences of our target species for comparisons.
Microwave Optimization for Testing Solid Content in WasteWater Facilities

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Faculty Research Mentor: Gabriel Judkins, Ph.D.
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Testing for Solid content percentage in Centrate, CFT, Cake, 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 not optimized 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 reclaim.
Cannabis has been used to treat a wide array of conditions ranging from pain to epilepsy, to appetite stimulation. Due to these potential medicinal properties the interactions of cannabinoids with the endocannabinoid system has been subject of recent interest. The endocannabinoid system primarily consist of centrally located CB1 receptors and peripherally located CB2 receptors, as well as their endogenous ligands. The interaction of Cannabidiol (CBD) and Δ9-tetrahydrocannabinol (Δ9THC) with CB1 receptors have been proposed to be the primary mediators for the psychoactive effects of cannabis, but when used in isolation, these effects are greatly diminished. One potential explanation for this discrepancy is that the 400+ other compounds in cannabis play a role in modulation of CB1 receptors, termed the entourage effect. In the present study we assess the role of terpenes, the aromatic component of cannabis, in entourage with 2-Arachidonoylglycerol (2-AG), an endogenous ligand for CB1 receptors. We used electroencephalography (EEG) recordings of the prefrontal cortex to evaluate circuit level changes from administration of multiple terpenes and terpenes with 2-AG. We found that administration of either terpenes or 2-AG increased delta oscillations. When both terpenes and 2-AG were administered together this increase in delta was amplified. This study demonstrates that terpenes may provide another component in the development of therapeutics targeting the endocannabinoid system. Further studies will seek to investigate the behavioral and cellular aspects of the entourage effect.
Altered Fine Motor Coordination as a Hallmark for Disrupted Developmental Processes

Ye Eun Nam
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Faculty Research Mentor: Dustin Hines, Ph.D.
Department of Psychology

Neurodevelopment is a sensitive and critical step in the maturation of an individual. Subtle disruptions in this process often lead to abnormalities in neuronal circuitry and behavior. One neurodevelopmental disorder that has a significant impact on an individual’s behavior is Rett syndrome, which is caused by mutations in MeCP2 gene. An understudied symptoms of Rett syndrome is the loss of motor coordination, however, broad motor coordination is clinically used for diagnosis. Broad motor coordination develops between 1 to 4 years, but fine motor coordination develops between 0 to 6 months. Finding correlations between Rett syndrome and fine motor coordination could allow for potent diagnosis. We hypothesize that mice with an altered MeCP2 gene will have deficits in performing high complexity movements and that these deficits are due to aberrant organization of neuronal circuitry. In this experiment, 4 MeCP2 mutants and 4 wildtype mice were prepared for 5 days of behavioral tests measuring broad to fine motor coordination. Brain slices of the premotor cortex were processed with the Golgi cox stain to evaluate organization and structure of neuronal circuitry of each group. We found that MeCP2 mutants displayed decreased coordination in both fine and broad motor coordination tasks compared to wildtype. These deficits are also accompanied by morphological alterations in the axon initial segments and dendritic spine densities. Neurological changes initiating from neurons altering neural circuitry may necessitate such behavioral changes in MeCP2 mutants. Major implications of this study can potentially provide earlier and effective diagnosis for cortical related disorders.
Processing of ozone is extensively used in wastewater treatment. This is due to ozone having the ability to breakdown coloured substances like dyes in wastewater, improving the turbidity and aesthetics of water. However, to treat heavily coloured industrial wastewater (e.g. textile wastewater), a high volume and concentration of ozone is necessary. Granulated Activated Carbon (GAC) has been proved to be a superior material during the removal of dyes from water. GAC is either regenerated or disposed in landfills after adsorption; the latter being the most common. This makes the individual application of ozone or GAC an expensive approach. Therefore, the purpose of this study is to concentrate methylene blue (MB) dye on GAC through column adsorption, along with in-situ regeneration of GAC using ozone. This will be done to improve the lifespan of GAC. We hypothesize that the concentration of methylene blue on GAC can reduce the amount of ozone needed to breakdown the same amount of dye if ozone was applied directly to dye solution.
Scientist and the private sector have been developing solutions to make Mars habitable by understanding what resources Mars has to offer and how those resources can be used to support human life. Applying water to dry Martian regolith can produce gases, solids, and other valuable elements that humans can use for creating oxygen, water, and propellants. The amount of hydrogen, perchlorate, and important elements that can be released during water-rock interactions are key to better understanding the possibilities and limitations of long-term human exploration on Mars. Anaerobic water-rock experiments will be conducted on a Martian simulant MGS-1 (a mineralogical standard for basaltic soils on Mars) to examine and quantify the abundances of its products. I will be using ion chromatography to analyze perchlorate, gas chromatography to analyze hydrogen, and an atomic absorption spectrometer to identify and measure the concentrations of other ions. The results of my research will identify possible resources available in situ to support long-term human exploration on Mars.
SESSION B

BUSINESS, LIBERAL ARTS, AND URBAN AFFAIRS LIGHTNING TALK PRESENTATIONS
Characterization of the Head Twitch Response (HTR) after Administration of 5-HT2A Receptor Agonist 25I-NBOH

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Department of Psychology

Faculty Research Mentor: Rochelle Hines, Ph.D.
Department of Psychology

Serotonin (5-HT) is a neuromodulator known to regulate attention and stabilize mood. Of the 5-HT receptors, the 5-HT2A receptor (5-HT2AR) is highly enriched in the frontal cortex and thought to mediate attentional processes. The 5-HT2AR also appears to be central to the mechanism of action for classical hallucinogens, which are receiving renewed attention as potent and long-lasting psychiatric therapies. In rodents, the head twitch response (HTR) serves as a read-out for 5-HT2A activation and potential hallucinogenic effects, yet less is known about the circuit level changes induced by hallucinogenic action at the 5-HT2AR. To better understand these changes, we used behavioral assays and EEG to characterize the HTR in mice after administration of the highly selective 5-HT2A agonist 25I-NBOH. In the open field, mice given 25I-NBOH exhibited a robust HTR and disorganized behavior which included frequent stops. Treated animals displayed the HTR as early as 3 minutes after drug administration, which confirms findings from previous studies characterizing the HTR using other 5-HT2A agonists. We also observed that as the 60-minute testing period progressed, the HTR became less frequent and animals had longer stops. We then performed a series of EEG studies to understand the patterns of activity that underlie the HTR, and found that a characteristic pattern composed of two distinctive waveforms (Phase I and Phase II) occurred after 25I-NBOH injection. This pattern also correlates temporally with the HTR, with Phase I preceding the HTR and Phase II mapping directly onto the HTR. Our findings contribute to our understanding of 5-HT2A actions, with major implications for clarifying the role of serotonergic signaling in the cortex for novel therapies.
Major Depressive Disorder (MDD) is a disorder that affects 300 million people of all ages, globally. Although serotonin was previously identified as a potential mechanism for depression, there are many caveats to this hypothesis. An alternative hypothesis, the Inflammatory Hypothesis of Depression states that active inflammatory and neurodegenerative processes are associated with effects such as anhedonia, low moods, depressive episodes, anxiety and weight loss. This hypothesis has led to findings of a noninvasive neuroinflammatory biomarker that is linked with the high expression of Translocator Protein (TSPO). TSPO is an 18kDa protein found in the outer mitochondrial membrane responsible for regulating the transportation of energy and is a therapeutic target for neuroinflammation. Subsequently, MDD is linked with an increase in peripheral inflammatory markers thus we examined the antidepressant-like effects of TSPO ligands PK-11195 and RO5-4864 in the Open Field Task (OFT). These drugs are both therapeutic and anxiolytic or have sedative/hypnotic effects at varying doses. In order to better understand its effects, the necessity of a drug-dose response curve is critical to find a dose without sedative/hypnotic effects. By analyzing behavioral responses of animals treated at different doses of PK-11195 and RO5-4864 in the OFT, the reduction of depressive-like behaviors can be demonstrated by the regulation of neuroinflammation and neurodegeneration in MDD. Arousal levels of TSPO expression can lead us to better analyze changes in behavioral activity. This study concludes that at low doses both drugs appear to have neuroprotective and therapeutic effects with the absence of any sedative/hypnotic effects.
Exposure to an enriched environment and nurturing stimuli is imperative for healthy neurodevelopment. Enhancing stimuli has been shown to have benefits in development, especially when presented during critical periods of the development process. In this study, mice from the same litter were presented with an enhanced environment in the form of tactile stimulation (TS) three times per day from postnatal day one to postnatal day twenty one, which marks the end of most critical periods. We assessed how the interaction with the environment changes in mice given TS. Behavioral assessments were used to measure resilience and social interaction in these mice. We also assessed the histological changes in mice who were given TS. Dendritic spine density and astrocyte density were measured using Golgi Cox staining and immunohistochemistry, respectively, in order to observe changes in neurons and glia. We found that density for both spines and the astrocytic endfeet associated with their synapses increased, and that there were more synapses in the prefrontal cortex of mice who were given TS than in that of mice who were not. Researching the role of glial cells in the synapses of mice who experienced high levels of tactile stimulation can help us find better treatment methods for neurodevelopmental disorders.
Although nearly three dozen states have legalized medicinal and/or recreational marijuana, the legal industry as a whole still faces challenges related to pricing, licensing procedures and fees, and banking services. The price of marijuana products vary drastically across the country which limits consumer choice and makes it difficult for the industry to compete against the black market. The exorbitant costs to license and start a cannabis business are significant barriers to entry which prevent many entrepreneurs from venturing into this new opportunity, let alone those most affected by the War on Drugs. Lastly, without access to institutionalized financial services, the industry operates largely on a cash-only basis, which presents many logistical and safety issues. My research aims to develop and explore possible policy solutions that address these issues at the local, state, and federal levels. My approach includes an analysis of marijuana regulations in a few states (mostly Nevada, Colorado, and Oregon) and comparing them against each other, and across similar industries, in order to determine which policy approaches are effective and which should be reformed. I have collected data from news reports, policy briefings, marijuana hearings, court sessions, and books on marijuana policy. Preliminary results indicate that the best path forward is in the implementation of gradual reforms which deregulate the industry in certain respects while increasing local, state, and federal initiatives in other areas. Through my research and policy recommendations, the risks associated with the current cannabis industry can be remedied for stakeholders at all levels.
Transiency and Elementary School Performance: Evidence from Clark County, Nevada

Ei Myint
Department of Economics

Faculty Research Mentor: Bradley S. Wimmer, Ph.D.
Department of Economics

School transiency is a common occurrence in the United States. Among industrialized countries, students in the United States tend to have the highest rate of school transiency (Long, 1992). The literature indicates two effects of transiency. The first effect deals with moving to get a better match for students, whereas the second effect suggests that moving is disruptive, interrupting the student learning process. However, transiency on average negatively affects students’ learning and behavioral outcomes, and the effects are worse among low income and racial/ethnic minority students (Llreas & McKillip, 2017). In this study, we examine the effect of transiency on school performance in Clark County, controlling for socio-economic factors. In addition, previous research findings on transiency are mixed, when examining the impact of transiency on English and Math achievements. As a result, our study examines the impact of transiency on schools’ English and Math proficiency rates separately by using log-level linear regression models on 189 elementary schools in Clark County, Nevada. Data is obtained from Nevada Report Card and American Community Survey. Results suggest that transiency negatively affects both English and Math proficiency rates. In addition, socioeconomic status and family education levels negatively and significantly impact both proficiency rates. However, limited language abilities only negatively affect English proficiency rates.
The future of artificial intelligence (AI) and automation in our economy is a hotly debated and highly anticipated concern among policy makers. Recent scholarly literature reveals that with the rise of automation comes net loss of jobs and the demise of some local economies. Because the Las Vegas-Henderson-Paradise metropolitan statistical area is economically concentrated in hospitality, it is at significant risk for disruption in the coming AI era. This study evaluates the effect of the previous IT era on employment composition in the region, draws on work by the McKinsey Global Institute and the Brookings Institute to assess the risk of automation across a number of occupations, and identifies the forms of automation and adaptation measures that businesses and local policy makers are considering. An analysis of occupation-specific employment data reveals that Las Vegas faces a substantially higher than average risk of automation than the vast majority of large metropolitan areas in the United States. This information joins a growing body of research that seeks to understand the simultaneous risks and opportunities presented by automation and AI. By considering past and future trends in job risk, this project will contribute to future research in artificial intelligence and similar topics as Las Vegas attempts to adapt to automation.
Using Place-based Investigation of Violent Offender Territories (P.I.V.O.T.), this study structures an examination of a specific violent offender location in Las Vegas. The P.I.V.O.T strategy focuses on identifying and disrupting crime place networks that do not typically come to the attention of the police with their usual investigative techniques alone. Utilizing data from the Las Vegas Metropolitan Police department’s P.I.V.O.T team, a location analysis was used to uncover a crime place network. Data was collected by reading crime reports and through qualitative interviews with the Las Vegas Metropolitan Police Department’s P.I.V.O.T. team. A correlation analysis will be used to identify a relationship between the location of crime and place-based management. The preliminary findings demonstrate that a network of criminal activity is emerging between offender territory and place management in Las Vegas.
State and Local Per Pupil Funding for Higher Education in the Mountain West States

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(1) Ed. W. Clark High School
(2) Brookings Mountain West
(3) The Lincy Institute

Faculty Research Mentor: Caitlin Saladino (1,2) & William E. Brown Jr. (1,2)
(1) Brookings Mountain West
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The Great Recession reduced state and local funding for higher education in the United States. As a result, students face reduced access to four- and two-year institutions of higher education. This article summarizes trends in state and local per pupil funding and the change in this funding over a ten-year period (from 2006-07 to 2016-2017) in the Mountain West states of Arizona, Colorado, Nevada, New Mexico, and Utah. The presentation of these data places the Mountain West states in the national context. Key data points are offered to reflect the financial impact of these shifts in educational funding. The presentation of these data is intended to encourage future research regarding the effects of the Great Recession on public higher education funding in the Mountain West region.
As third-wave feminism continues to expand the discourse on trans and non-binary identity, a return to second-wave French Feminism is imperative in order to further inform the discourse on a range of topics such as body autonomy, queer identity, sexual difference, and what it means to be a “Being”. This presentation is focused on the works of French Feminist author Hélène Cixous and the pioneering work on psychoanalysis by Sigmund Freud and Jacques Lacan. By recontextualizing key psychoanalytic ideas that have been since discredited in modern times into terms that will function as tools of literary analysis, third-wave identity politics discourse can be given a different perspective. A term that was created throughout my research, I explore what “non-sexual difference” means in 2019, and how this term applies to contemporary Gender and Sexuality studies. Prevalent throughout much of her work, Cixous’s 70’s novels demonstrate bodies that resist reification, bodies that are not signified by tradition signifiers of masculinity or femininity. These demonstrations of non-sexual difference are crucial to understanding the Trans* and non-binary self.
SESSION C

EDUCATION, ENGINEERING, FINE ARTS, HEALTH SCIENCES, AND PUBLIC HEALTH POSTER PRESENTATIONS
A back tuck is a countermovement jump with the addition of a backwards-rotating somersault performed with the knees held in close to the chest during the flight phase of the jump. Although the back tuck is a foundational skill in many acrobatic disciplines, there is currently a lack of research examining the biomechanics behind the movement. Warm-up studies are conducted in many sports and acrobatics should be no exception. Therefore, the purpose of this study was to compare back tuck performance after a static warm-up vs. a dynamic warm-up. Performance will be measured based on the subject’s Reactive Strength Index (RSI = jump height/jump time) with higher scores indicating stronger performance. Subjects with at least five years of experience in performing the back tuck will be studied. They will perform 5 back tucks after a static warm-up and then after a dynamic warm-up. All trials will be performed starting and landing on a force platform with data collected at 1000 Hz over 5-7 seconds. Data from research in other sports suggests that a dynamic warm-up is best for optimal sports performance. We hypothesize that the back tucks performed after a dynamic warm-up will have a higher RSI. The results of this study will provide insight into more efficient ways from acrobats to prepare for their sports, optimize performance, and ultimately lay the foundation for further research into injury prevention and proper back tuck technique.
Over the years, NASA has sent multiple rovers to Mars to determine the planet's environment and to discover its similarities to Earth. Each rover was built differently based on its mission; which would range from collecting dirt to looking for water. Currently, NASA is planning to send a rover in 2021 in search for life in Mars. As NASA continues to enhance their rovers they are based on previous rovers and new findings which can help the rover succeed in its mission. In this project, the focus was to build a high duty rover using equipment that can prepare the builder for NASA opportunities in the future. The rover would consist of 4 wheels, a roboclaw, CORE2, microcontroller, and several other components. In addition, the rover would carry sensors, a camera, and lidar, which will help the rover drive autonomously. At the end the rover is to map the path it travels and to recognize the objects around it while memorizing their positions for future encounters.
Machine Learning to Detect Walking Flies

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Faculty Research Mentor: Sarah Harris, Ph.D.
Department of Electrical and Computer Engineering

Machine learning can be used to solve many problems that are difficult for programmers to find algorithms for. Machine learning is very rarely limited in what it can detect and can be used in many applications. We built a fly roller system that effectively rotates motorized wheels at multiple speeds that is selected by the user. The rotation of the plastic tubes will cause the fruit flies to walk around the circumference of the tubes and eventually exercise the flies. The problem is, sometimes the flies stick to the tubes and stop walking. We want to use machine learning to properly monitor the flies to detect that they are walking correctly in the tubes and not sticking or allowing themselves to be rolled by the device. The first step is creating object detection with a fake fly in one of the fly rollers plastic tubes. The next step is creating detection of the ‘fly’ not being rolled and allowing the program to label this as ‘sticking’. Then we will create detection of the fake fly walking with the tube and label it as ‘walking’. The final step is using the knowledge gained from the fake fly to use with a real fly in the actual fly roller. The end result would be to have the program properly detect if any of the flies are sticking to the fly roller while the fly roller is rotating.
Monitoring Galena Creek Bridge

Elizabeth Martinez & Ryan Sherman
Department of Civil and Environmental Engineering and Construction

Faculty Research Mentor: Jee Woong Park, Ph.D.
Department of Civil and Environmental Engineering and Construction

Located between Reno and Carson City, Nevada, the Galena Creek Bridge is the largest concrete cathedral arch bridge in the world with an arch span of 689 feet and total bridge length of 1,725 feet. The bridge serves as a transportation connection for Interstate 580 and US Route 395. A structural-health monitoring (SHM) system will be installed within the bridge to assess the response to seismic events. Accelerometers will be used to measure the seismic response. The Nevada Department of Transportation (NDOT) will receive live alerts from the monitoring system to quickly respond to high-risk concerns. A supplementary monitoring system will be utilized to support the primary seismic SHM system. The supplementary system will monitor the impact of thermal, wind, and routine traffic loadings. Potentiometers will measure displacement due to thermal expansion at the abutments and expansion joints. Temperature probes will observe both superstructure and ambient temperature to adequately evaluate thermal expansion data. Inclinometers will record tilt at various bridge columns. Lastly, an anemometer will measure wind speed and direction. The supplementary sensors, in conjunction with the primary SHM system, will provide vital data for NDOT to evaluate the long-term structural performance, inform maintenance actions, and respond to extreme events. Ultimately, the systems will increase public safety by continuously monitoring the structure, while contributing to future advancement of SHM on bridges in Nevada and beyond.
Research has long understood that popular culture can help motivate students (Frey & Fisher, 2004). Popular culture, since then, has been used as a teaching tool to not only engage students, but also reach multicultural students (Tuzel & Hobbs, 2017). With the rise of unconventional media in an English secondary classroom and the demand for more diverse content in schools across the United States, there is still little written about the implementation and use of anime and manga in K-12 education. Anime, however, may pave a way for pre-service teachers to establish and engage their students in content that has rich form in both literature and video media, while promoting diversity for untraditional students. This research will specifically critically analyze Naruto (in both anime and manga formats) to show the value in its themes, plots, and characters; as anime and its content has been researched to have a positive influence on students beyond their adolescence (De Jesus, 2014). By doing so, pre-service teachers will be able to understand that manga and anime also has strong educational value in the classroom when carefully curated. Anime, by nature, also opposes the notion of the Western Narrative, an idea that is detrimental to wholistic multicultural understanding and education. As such, this study will account the counter-narratives of pre-service teachers and show the importance of having content like anime and manga to relate, engage, and teach their students in their classrooms.
Utilizing Spray Aeration for Removal of Trihalomethanes in Disinfected Water

David Rouhani (1), Alicia Cheung (2), Erica Marti (2)
(1) Department of Mechanical Engineering
(2) Department of Civil and Environmental Engineering and Construction

Faculty Research Mentor: Erica Marti, Ph.D.
Department of Civil and Environmental Engineering and Construction

Trihalomethanes (TTHMs) are a byproduct found in disinfected water after chlorination. A significant accumulation of TTHMs have a positive correlation to other potentially harmful byproducts; therefore, removal of TTHMs provides safer drinking water and abides by distinguished regulations. Due to the volatility of TTHMs, TTHMs prefer to transfer from water to air. The volatile characteristic allows for relatively cost-effective methods in removal of the byproduct. This experiment utilizes variables in air ventilation to alter spray aeration conditions. The conditions tested to find the most efficient procedure, in which the greatest percentage of TTHMs was removed. A specially designed water tank and interchangeable ventilation system was created and for this experiment. The inlet and outlet water samples from the tank were measured and compared. The results indicated certain fluid conditions show greater efficiency in removing TTHMs.
Route Navigation of Autonomous Ground Vehicle in a Simulated Clustered Environment for Radiation Source Localization and Mapping Research

Giovanny Vazquez & Woosoon Yim
Department of Mechanical Engineering

Faculty Research Mentor: Woosoon Yim, Ph.D.
Department of Mechanical Engineering

Route Navigation of Autonomous Ground Vehicle in a Simulated Clustered Environment for Radiation Source Localization and Mapping Giovanny Vazquez and Woosooon Yim (faculty mentor), Department of Mechanical Engineering, University of Nevada, Las Vegas. Currently, there exists an urgent need for developing autonomous robotic vehicles for first responders to effectively aid rescue and explore the sites in a nuclear accidents or other types of disasters. The work addresses developing a radiation source localization and mapping algorithm for autonomous ground robotic vehicles (UGV) in clustered environment with obstacles. To validate the proposed algorithms the simulated environment was developed using Gazebo robot simulator with Rviz (Robot Operating System (ROS) visualization software). The radiation data set for the simulation environment was obtained from Monte Carlo N-Particle code (MCNP) and contains position-stamped gamma-ray peaks. In this study, two different sensor types are used on the UGV. One is for radiation measurement and the other is for the range. For radiation measurement three equally spaced radiation sensors mounted on a rotating platform is proposed to perform radiation measurement as well as gradient direction determination. For the range measurement a scanning Lidar range finder is used for avoiding obstacles within its field of view (FOV) in the clustered environments. The research goal is how to utilize radiation and Lidar sensor data effectively to navigate the UGV in radiation contaminated clustered environments such as nuclear power plants or nuclear accident sites. In this study a heading angle of UGV is determined by (1) radiation gradient estimation by spinning radiation sensors and (2) obstacle avoidance based on “Follow the Gap Method” where UGV seeks the heading toward the maximum gap within its FOV. The proposed algorithm was validated in the robot simulator Gazebo with embedded radiation data calculated by MCNP code.
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. Analyses included suicide mortality data during 2008-2017 from the Multiple Cause of Death Centers files 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 2009 and 2017, which were also examined within and between racial groups. Top suicide methods were also identified. All rates were calculated per 100,000. We expect to see a general increase in suicide rates across all age groups, significantly high percentage increases affecting youth ages 5-14 years. Using a more thorough data analysis we hope to more accurately depict patterns in the data and give a more precise interpretation of this mortality data to depict suicide patterns in school-aged children and young adults in the United States.
This research focuses specifically on writings and lectures by Leonard Bernstein and Arthur Berger, two members of what composer Aaron Copland colloquially refers to as “The Stravinsky School”. It intends to serve as a starting point from which to develop a more definitive and comprehensive idea of American mid-twentieth century music. I outline their attitudes regarding the state of their generation’s classical music on a broad scale through consultation of Bernstein’s The Joy of Music and Berger’s Reflections of an American Composer. Additionally, I will listen to Bernstein’s What Is Classical Music, a lecture recorded on January 24, 1959. I acknowledge that examining these sources is not a completely comprehensive display of the attitudes held by mid-twentieth century composers and scholars on their classical music. However, the individuals studied are accomplished academics and composers in their own right understanding the rich history and foundational importance of their classical predecessors (Beethoven, Bach, et al.) as well as the influences that developed American popular music, primarily Jazz and American Popular Musicals, that are also said to have had a significant influence on “classical” music composed in America. The hope in examining what these two have observed regarding the patterns of classical music in America is that it will better define what American classical music is, or if such a thing exists. It also allows us to argue if American music rooted in popular culture such to the degree that it pitches American music outside the classical genre.
Human osteoarthritis is seen as the degeneration of joint cartilage leading to stiffness of that joint and often pain that hinders its use. Dogs are one of the few animals with natural occurring hip dysplasia that, over time, can lead to osteoarthritis of the hip. This allows for a reliable model to better understand human osteoarthritis; however, the canine hip dysplasia etiology is not greatly understood. To improve this model, dynamic hip laxity analyzed using high speed biplane radiography as well as pressure plate gait analysis can be used for better insight into canine hip dysplasia. We will conduct the study using ten medium sized dogs from breeds that are highly prone to canine hip dysplasia and from breeds that are less prone. A high speed biplane radiography system will be constructed over force plates. The dogs moved across these plates at three speeds (walking, trotting, and running). The use of two x-ray sources crossing each other into corresponding image intensifiers, allowing for an area that provides x-ray images of one object at one time with two differing perspectives. When the dog passes through the area a series of three dimensional x-ray images are produced once the two perspectives are merged. The x-ray images taken will be processed through a program using machine learning to fit an ellipse to the femur head and acetabulum to measure for hip laxity in every frame collected. This will allow for a quantitative analysis of hip laxity during dynamic locomotion.
SESSION D

HOSPITALITY, LIBERAL ARTS, AND URBAN AFFAIRS POSTER PRESENTATIONS
Axon Initial Segment Morphology in Neurodevelopmental Disorders

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Neurodevelopmental disorders (NDDs) are a group of heterogeneous syndromes characterized by abnormal brain development causing deficits in language, learning, memory, and social skills. Rett syndrome is a type of NDD characterized by a high occurrence of seizures which result from uncontrolled action potential firing. Action potential firing is initiated in the axon initial segment (AIS), and this important cellular compartment may be subject to specific developmental changes that impact its morphology and its threshold of excitation, contributing to the symptoms of NDDs like Rett syndrome. We hypothesize that abnormalities or differences seen in AIS morphology leads to the phenotypes observed in Rett syndrome. To investigate this hypothesis we will examine the morphology of the AIS in a mouse model of Rett syndrome (Mecp2+/-) compared to wildtype controls. We have analyzed length, tortuosity, and angle of the AIS in frontal cortex cells for both WT and Mecp2KO mice. Our results indicate that the AIS of Mecp2+/- mice are shorter, more tortuous, and have less angled over-all shapes as compared to WT mice. These morphological changes provide insight into structural changes at the AIS that may contribute to aberrant action potential firing patterns and seizures in Rett syndrome. Understanding the role of the AIS in NDDs like Rett syndrome may allow for development of novel treatments.
The conclusion of the Pacific Theater caused Japan to suffer a great loss in its economy due to the industries and infrastructures obliterated by the war. Yet, a few years later, Japan witnessed a significant increase in its economy with the stimulation in the private sector, the creation of new industries, and the economic incentive from the Korean War, resulting in a high-yield economic growth – commonly known as the “economic miracle.” Albeit, American intervention after the war is known as the predominant guarantor of this miracle, American occupation in Japan was not the only variable for this economic post-war reconstruction. The remarkable economic performance demonstrated after the war resulted from past economic policies and heavy intervention in the market by the Japanese government. This then laid the foundation and framework for its unprecedented economic revival. This paper examines Japan’s foreign policy principles – Sakoku, Fukoku Kyōhei, & The Yoshida Doctrine – from the Early Modern, Modern, and Contemporary periods of Japan, and details the deep-rooted economic development stages that assisted the post-war economy. In doing so, this paper highlights the implications of each policy, relative to their respective time period, and their roles in progressing Japan’s fast-tracked economic recovery and asserting the nation’s place as the first non-Western economic powerhouse of the 20th century.
Does Neurodevelopmental Diagnosis Effect Baseline Testing for Sport Concussion?

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Objective: The ImPACT is used to examine cognitive abilities before and after concussion. Research has shown that athletes with neurodevelopmental diagnoses may perform more poorly on ImPACT (Elbin et al., 2013; Manderino & Gunstad, 2018). The present study investigates the effect of neurodevelopmental diagnosis on frequency of invalid baselines.

Procedures: Participants included 44,578 high school and collegiate athletes (Mage=15.2, Meducation=9.1 years, 44.6% female) who completed the ImPACT as a baseline. Athletes were included from the following distinct categories based on self-report: ADHD only (3.4%), Learning Disability (LD; 1.4%), Autism (0.2%), ADHD+LD (0.6%), Autism+ADHD/LD (0.1%), athletes with special education (SpEd) history but no diagnosis noted (1.2%), and healthy athletes with no diagnosis (93.1%). 5.4% of baselines were invalid. There were no differences in invalid baselines between athletes with (8.4%) and without concussion histories. Chi-square tests of homogeneity were performed to evaluate differences in rates of invalid baselines based on diagnosis.

Results: Invalid baselines differed significantly across groups (p<.001). Post-hoc pairwise comparisons indicated that athletes with ADHD, LD, ADHD+LD, and SpEd history had 2 to 4 times more invalid baselines (p<.05) than healthy athletes. No differences were seen for athletes with Autism, and athletes with Autism+ADHD/LD.

Conclusions: Athletes with ADHD, LD, ADHD+LD, and SpEd history returned more invalid baselines than the other subgroups examined. These results demonstrate that current cut-off for invalid baselines may not accurately capture suboptimal effort for those with neurodevelopmental diagnoses. Future research should examine the utility of separate normative data for athletes with a neurodevelopmental diagnosis.
Drawing on self-determination theory, this paper investigated the level of racial discrimination in the hospitality industry and examined its effects on hospitality career satisfaction. Based on a sample of 179 hospitality students who were working in the industry, the study showed that racial discrimination is prevalent in the hospitality industry such that people of color suffer from a higher level of discrimination than Whites people. However, there is no difference in racial discrimination among racial/ethnic minority groups. Structural equation modeling results also showed that a high level of racial discrimination results in a lower level of hospitality career satisfaction due to the depletion of basic needs satisfaction. Overall, the results suggested that people of color have a lower level of career satisfaction via the mediating roles of racial discrimination and basic needs satisfaction. This study makes three theoretical contributions, including showing the level of racial discrimination in the hospitality industry; suggesting discrimination can affect hospitality career satisfaction – an outcome that has an industry-wide impact; and explaining the mechanism through which racial discrimination affects hospitality career satisfaction. Such an investigation can provide meaningful practical implications as to how hospitality organizations can mitigate the effects of discrimination and shed lights on how to keep current and future talent in the hospitality industry.
Most crime in Southern Nevada is on a downward trend. Officers in each of Clark County’s police jurisdictions are arresting fewer people across the Las Vegas Valley and the surrounding metro area. The present study utilizes the FBI’s Uniform Crime Reporting (UCR) Program to measure the number of arrests made over ten years for a variety of illegal activities, including drug abuse, violence and murder, property crimes, sex crimes, alcohol-related crimes, theft, white collar crimes, and other offenses. This dataset summarizes arrest trends from 2006 to 2016—before, during, and after the Great Recession—to examine the implications of static versus changing crime rates. In keeping with the current findings regarding policing and prisons in the U.S., this study is meant to gauge the contingent levels of convictions and incarcerations in Nevada’s most populous metro.
Traumatic brain injury (TBI) has long been a leading cause of death amongst children and young adults worldwide, and in the U.S. military it known as the signature wound of the Iraq/Afghanistan wars. The mechanisms of TMS are still unknown. We theorized that following administered brain damage, TMS could be used to stimulate glia cell activity stopping the progression of reactive gliosis in the areas surrounding the point of insult. Therefore, using TMS following TBI we aimed to measure behavioral outcomes after administering TMS, physical change in glia cell anatomy, and dendritic spine count. Our results showed that following TBI when TMS was administered higher numbers of dendritic spines were present in the motor cortex, depressive symptoms lessened, and glia cell anatomy differed from the control. The results that TMS can alter glia cell anatomy, spine count, and behavior suggests that TMS could possibly be use to interrupt the progression of reactive gliosis. In stopping this negative glial progression it is possible that TMS can be used as a treatment to stop the transition of a healthy brain to one with disease, bringing an end to diseases categorized by chronic reactive gliosis such as chronic traumatic encephalopathy (CTE).
Recent developments in the field of useful hard x-ray induced chemistry synthesized a novel strontium-based CO derived material under extreme conditions. In hopes of synthesizing this material in larger quantities and in less expensive costs, we report three experiments on Tin Oxalate (SnC2O4) subjected to extreme conditions without the use of hard x-rays. In the first experiment, Raman spectra of SnC2O4 were acquired up to 25-30 GPa. In the second experiment, a UV irradiation study during varying pressures was conducted. In the third study, we examined large quantities of SnC2O4 in high temperatures (~500K) and low pressures (>5 GPa) under a Large Volume Press.
The Hawaiian Islands are inferred to be a product of mantle plume activity. The growth cycles of Hawaiian volcanoes can be explained in 4 stages: pre-shield, shield, post-shield, and rejuvenated. Differences in geochemical signatures, temperature variations, changes in magma supply rates, degrees of partial melting and crystallization distinguish each volcanic stage. The pre-shield and post-shield stages of volcanism, dominated by alkalic lavas, experience lower degrees of partial melting while the active shield stage, dominated by tholeiitic lavas, showcases higher degrees of partial melting due to its proximity to the mantle plume’s focus. Loihi Seamount is the youngest active volcano in the Hawaiian-Emperor Chain. It is located approximately 35 km from the Big Island of Hawai’i and rises approximately 1000 meters below sea level. Pre-shield stage volcanism is under examined due to the volcanoes present on Earth, such as Mauna Kea and Kilauea, having surpassed this initial stage of volcanic growth. Due to its young age, submarine nature, and not being easily accessible, Loihi, as a whole, is under-studied as well. We have analyzed 53 Loihi lava samples for their major and trace element compositions. Our preliminary data show an alkalic signature with higher concentrations of sodium and potassium (1.6 to 6.4 wt. %) and an enrichment of incompatible elements; results that pertain to the expected compositions of pre-shield stage volcanism. Our analysis will assist in the understanding of the geochemical components, the development, and growth stage of this emergent volcano.
In the spring of 2018, we excavated a partial skeleton of a Columbian Mammoth from Amargosa Valley, Nevada under permit from the Bureau of Land Management. Three plaster field jackets were constructed and transported to the Richard A. Ditton Learning Lab at the Las Vegas Natural History Museum. There, we have been preparing the three plaster field jackets, which contain both partial tusks and a cranial bones of this mammoth. Fossil preparation is necessary for this project to assess which skeletal elements are present, as well as the ensure the long-term conservation of these specimens. Procedures used for this process include removing sediment using hand tools and pneumatic tools, as well as the use of Paraloid consolidents. Sediment was also collected within the field jacket and screen-washed for microfossils. The mammoth bones are in varying states of preservation, with a lot of portions being fairly soft and fragmented. Moving forward with this project, we hope to prepare the second largest field jacket containing postcranial elements, conduct a taphonomic analysis of the Fairbanks Spring Mammoth, and understand what environment the mammal may have lived and died in.
The Effect of mfd on Three Paraquat-tolerance Genes During Disulfide Stress in Bacillus subtilis

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The effect of mfd on three paraquat-tolerance genes during disulfide stress in Bacillus subtilis. All cells experience oxidative stress for a variety of reasons, such as a host response to pathogens. Cells have developed many mechanisms to cope with oxidative stress, but these mechanisms are not well understood. Previous RNA-Seq experiments revealed mfd—the transcription coupled repair factor in Bacillus subtilis—also protects against protein oxidation. We investigated the interactions between mfd and three paraquat stress genes that are downregulated in the absence of mfd: aldY, cypC, yfhE. Utilizing transformation, a variety of mutant strains were generated. Cells with a singular gene knocked out (aldY, cypC, or yfhE), double mutant cells with a knock out and mfd deficient combination, as well as wild-type and mfd deficient controls were subject to disulfide oxidative stress. An estimated percent survival was calculated by exposing the created strains to oxidative stress and dividing treated by untreated cells. Results may provide indication of the relationship between the paraquat stress genes and mfd; because mfd controls expression of aldY, cypC, and yfhE, the survival rate of double mutant strains and mfd deficient cells may be similar. These results as well as continued investigation of genes regulated by mfd are important because they provide insights into previously unknown functions of mfd in B. subtilis (a Gram-positive model organism), and in particular how cells manage the ubiquitous stress of oxidation.
Ubiquitin-Dependent Proteolysis is a Novel Hibernator

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In classic hibernators such as the golden-mantled ground squirrel, 1 to 3 week long bouts of torpor are characterized by low body temperatures (approximates ambient temperature to as low as -2°C) and low oxygen consumption rates (to as low as 1% of active rates). These bouts are interrupted by ~12 to 20 h periods of euthermy wherein homeostatic processes like protein synthesis or protein degradation are restored. Common tenrecs (Tenrec ecaudatus) do not experience the interbout arousals and may also hibernate at temperatures of as high as 28°C. An appropriate question then is what happens to protein degradation in these basoendothermic placental mammals. Ubiquitin-dependent proteolysis is primarily responsible for degrading the majority of regulatory proteins. In this process, proteins are tagged with ubiquitin and then degraded by the 26S proteasome. Unlike the process of protein degradation, ubiquitylation in ground squirrels is not very temperature sensitive. As a result, ubiquitylated proteins accumulate during torpor and increase 2 to 3 fold as compared to summer active or interbout aroused squirrels. The aim of this project is to determine the concentration of ubiquitylated proteins in the livers of the tenrecs using a sampling scheme that will allow to dissect out the effects of temperature from hibernation state.
Studying the Role of V-ATPase in Eye Regeneration

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Some species have developed mechanisms that allow them to regenerate organs or appendages after injury. One of these species is the Xenopus laevis, or the African clawed frog. While the full regeneration process of these aquatic frogs is not fully understood, vacuolar-ATPase (V-ATPase), a hydrogen ion pump has been found to play a role in eye and tail regeneration. Inhibiting V-ATPase with concanamycin A, an antibiotic, has been found to impede tail regeneration in tadpoles of Xenopus (Adams, et al, 2007). For eye regeneration, our lab has previously shown that Xenopus embryos can regenerate a fully functional eye by five days post-surgery (Kha, et al, 2018). The overall goal of the study is to determine the role of V-ATPase during eye regeneration through inhibition with concanamycin A. My project is to analyze the morphology of the various tissue layers in the treated regenerated eyes. This is to determine if the regenerated eyes have the same tissues as a normal eye through paraffin sectioning and hematoxylin and eosin staining. We performed eye surgery on one eye of stage 27 tadpoles. After surgery the embryos were treated with a 20nM concanamycin A. After five days, we observed that concanamycin A treatment inhibited eye regeneration as the operated eyes were smaller than the normal developing eyes. I will examine the concanamycin A treated eyes to determine their organ structure. These results will add to our current understanding of the role of V-ATPase in the eye regeneration process. Increasing our understanding of eye regeneration may have significant medicinal applications.
Identifying the Genomic Impact of Obesity in Starvation-selected Drosophila

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Drosophila melanogaster is a model species for studying physiological and genomic processes commonly found in humans. Previous studies have evolved obese phenotypes in Drosophila through starvation selection. We carried out starvation selection on five distinct populations of Drosophila melanogaster. DNA samples were collected from each selected population of flies to conduct a Genome-wide analysis study (GWAS). A total of 814,408 single nucleotide polymorphisms (SNPs) were identified across the genome at 120X coverage. Using Principal component analysis (PCA) we determined that after only one generation of starvation selection, the five selected populations cluster together away from the founding control population. To pinpoint SNPs at different frequencies between the founding population and our generation, we determined that about 10,000 were significantly different in allele frequency. We observed thirteen shared candidate genes between the five populations. Of the thirteen candidate genes, seven of them were clustered on the 3L chromosome. Results indicate rapid genomic evolution in response to starvation selection. With these results and the association between the genotype and phenotype of Drosophila melanogaster, we hope to eventually compare similar genes within humans to make a connection between the human genome and obesity.
Stroke is the leading cause of serious, long-term disability in the United States and leaves more than half of all survivors with diminished mobility. Tissue death caused by stroke activates a strong immune response that can lead to secondary damage and loss of tissue. The immune response is mediated by microglia which are the resident immune cell of the central nervous system. The immediate and secondary response denote the shift between an acute and chronic immune response. These stages are implicated in disease outcome, thus are ideal targets for identifying time points for intervention. Microglia can respond to electrical activity, making transcranial magnetic stimulation an ideal target for non-invasively modulating microglia activity. Upregulating microglia activity using transcranial magnetic stimulation has the potential to alter immune activity in the acute and chronic stages of pathology, resulting in less severe outcomes with regard to lesion size and mobility. Given these results, further studies should look at targeting microglia activity with transcranial magnetic stimulation for brain recovery in other diseases characterized by reactive gliosis, like TBI.
Accelerating Materials Discovery Through Machine Learning and Optimization Methods

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It is of the upmost importance to develop new computational tools that accelerate and drive down the cost of advanced material discovery. Machine learning and optimization methods, when applied to problems in materials science, can be used to accelerate and drive down the cost of advanced materials discovery through utilizing the already present data gathered by experiment and new data generated first principles simulations to drive. Recently, there has been a growing effort to incorporate data-driven methods into current first principles simulation methods through generating interatomic potentials through machine learning. To further this effort, we are developing a neural network-based method to generate interatomic potentials for molecular dynamics simulations applicable to wide range of materials classes.
SESSION F

LIFE SCIENCES POSTER PRESENTATIONS
Homeothermic mammals utilize internal thermoregulation to maintain warmer body temperatures, a trait that suggests warmer body temperatures are more advantageous in relation to their homeostatic processes. However, recent studies on Tenrec ecaudatus reveals varying preferences in body temperatures, despite being homeothermic mammals. This research project investigates the phenotypic plasticity of Tenrec ecaudatus by concentrating on their metabolic rates and body temperatures in order to provide insight on their homeostatic processes with respect to extreme temperatures. The experiment is performed by use of a shuttle box made of two compartments which Tenrecs can freely move back-and-forth between. The stimuli is temperature: one compartment contains a cold temperature (5°C) and the other compartment contains a hot temperature (40°C). Given that neither compartment is at optimal temperatures for the Tenrecs, we will see how they respond to these extreme conditions by monitoring oxygen consumption, heat transfer, body temperature, and movement. If Tenrecs were to act as an ordinary homeotherm, they would alternate between each compartment to maintain a set body temperature. However, given the unique nature of Tenrecs, we suspect that their behavior will not be based on a predetermined body temperature, but will instead be based on regulation of metabolism. In essence, their movement between each compartment is not governed by body temperature but is instead governed by the facilitation of metabolism. Exhibiting this project will advance our knowledge on the homeostatic processes of Tenrec ecaudatus: a species that seems to break the rules of standard homeotherms.
The woody genus *Metrosideros* (Myrtaceae) is a taxonomically difficult group that dominates the Hawaiian Islands, where it inhabits an exceptional range of environments. It is relatively new to Hawaii, arriving about 3.1 million years ago, and has since diversified into a large number of morphologically diverse forms. On O`ahu, field observations indicate the presence of 10 vegetatively distinct taxa in the Ko`olau Range, 8 of which occur in consistent sequence from low to high elevation on the many leeward ridges of the volcano. With increasing elevation, trees are exposed to increasing rainfall, wind and cloud cover. In a previous study, we found that vessel diameter was wider for taxa at drier areas, most likely due to a greater need for water transport since vessel diameter is known to relate positively to hydraulic conductivity. However, not much is known about the leaf venation architecture, which influences a variety of functions such as gas exchange, hydraulic conductance, and hormone and sugar transport. I propose to investigate the how leaf venation varies along the steep elevation gradient of the Ko`olau Range. To study leaf venation, I followed a protocol developed by plant physiologists at UCLA, using the software ImageJ. Preliminary results suggest that leaf venation varies among some taxa in a pattern that may be consistent with stem vessel diameter.
Evolution of Homologous Inter-Domain Linkers in Proteins

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In most genes there are several functional domains and non-functional sequences of DNA in between them. Linker regions are the segments of DNA between functional domains that act as a bridge between the different regions of proteins. These regions have been known to have a higher mutation rate than is present in their functional domain counterparts, suggesting that the composition of these regions may be less important than that of other regions and also a unique evolutionary history. Whether it is aiding in the structural analysis of proteins or adding to the base knowledge of protein engineering, the study of linker regions is a rich if understudied subject. For this reason, we have constructed a database of linker regions organized by gene tree based on data harvested from ENSEMBL, Pfam, and Superfamily databases. From this database we have found that linker regions have a median length of 37 bp and are enriched in S and L, and deficient in X and Y compared against the proportions found in functional domains. This database will not only allow our own research on linker regions to be conducted, but also is made public so that other researchers may study the evolution of linker regions.
Depression is a mild disorder in the brain that can become lethal. Suicide is the number one cause of death for teenagers and young adults, yet the chemical and morphological changes in the brain that occur in the development of depression are widely unknown. In this experiment, mice developed anhedonia and depression-like symptoms by performing the force swim task for six minutes for ten consecutive days. Swim trials were recorded and the time that each mouse was immobile (floating) was scored. The mice showed an increased amount of immobility that plateaued over the course of the experiment. This correlates to the mice having ultra-mild chronic stress and the development of anhedonia. After ten days, the brains were extracted, and the Golgi staining method was used for half of the mice and immunohistochemistry (IHC) was used for the remainder. Mice with depression-like symptoms showed a decrease in dendritic spine density in pyramidal neurons in the cerebral cortex. Furthermore, these mice had an increase in TSPO expression in the cerebral cortex. This experiment gives insight to how the brain changes after ultra-mild chronic stress and in the development of depression, which provides new targets for therapeutic practices and medications for patients with depression or ultra-mild chronic stress.
In the synthesis of oxadiazole-based azomethine compounds, the functional groups amine and aldehyde are reacted in an acid catalyzed condensation reaction to form a banana-shaped azomethine compound as well as the condensation product of water. The para-oxadiazole core is proven to possess liquid crystalline properties on heating after a reaction with 4-n-alkoxybenzaldehydes. Analysis of the para-oxadiazole liquid crystals (LCs) shows transition temperatures at the relatively high temperatures that are in the range of ca. 130-160 °C. The high transition temperatures of these LCs can be lowered to room-temperature by substituting 4-n-alkoxybenzaldehydes for the more flexible 4-ethoxyethoxyethoxybenzaldehyde and similar multiple oxyethylene containing aldehydes. The more oxygen atoms in the oxyethylene groups that are attached to the oxadiazole core will increase the flexibility of the compounds and in turn lower the melting transitions of the targeted compounds. The reaction between a para-oxadiazole core containing diamine and multiple oxygen containing benzaldehydes is demonstrating less reactivity and oftentimes producing a mixture of mono- and di-products that rendered difficulty for purification. Currently, we are exploring the methods of synthesis on an ortho-oxadiazole core containing diamine based azomethine compound that is believed to have similar reactivity and similar properties of a room-temperature LC because of this diamine availability in our lab. Ortho-oxadiazole diamine and decyloxybenzaldehyde were reacted in glacial acetic acid on heating to reflux. The condensation product water was removed through vacuum distillation in a rotary evaporator and the system is reassembled to allow for further reactivity. The resulting compound is purified by recrystallization.
Mandibular Facial Dysostosis with Microcephaly (MFDM) is a rare disorder characterized by craniofacial abnormalities as well as developmental delay. Mechanisms that lead to MFDM are still not well understood. It is thought that the spliceosomal protein encoded by EFTUD2 (Elongation Factor 2 Tu GTP Binding Domain Containing 2) plays a significant role in the development of MFDM. In this study, we show that an EFTUD2 haploinsufficiency in mice models gives rise to improper formation of cortical layers by analyzing sections of the embryonic cortex and subsequent cortical matter. Also, RNA-seq and functional analysis showed intron-retention and exon-skipping transcripts that ultimately led to nonsense mediated decay (NMD). This suggests that an EFTUD2 mutation leads to improper splicing during neural development which results in MFDM. We also show dysmorphologies and abnormal growth rate of human embryonic kidney cells (HEK 293) when transfected with plasmids designed with an EFTUD2 mutation. Overall, this study identifies EFTUD2 as a single key gene in the formation of MFDM.
An Examination of Alzheimer's Disease Pathology: Neuroinflammation in GABA Knockout Mouse Models

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Alzheimer’s disease (AD) is a neurodegenerative disorder marked by cognitive deficits and learning and memory impairments. It has three core biological pathologies: beta-amyloid plaques, neurofibrillary tangles, and chronic neuroinflammation. A chronic inflammatory response in the brain has been shown to both actively damage neurons and exacerbate the effects of plaques and tangles. Gamma aminobutyric acid (GABA) is the brain’s primary inhibitory neurotransmitter and has been shown to play roles in learning and memory. It mainly functions in inhibiting active processes, and has been shown to be reduced in AD patients and mouse models. It is believed that GABA could play a role in modulating chronic neuroinflammation and related AD pathology. The aim of this study is to evaluate changes in inflammation in a mouse model lacking GABA-B receptors and to better characterize GABA’s usefulness as a novel AD treatment.
Screening for Rosickyite Production in Chemolithrophic Isolates from Badwater Basin (Death Valley, CA)

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This study investigated whether chemolithotrophic microorganisms isolated from Badwater Basin in Death Valley National Park, CA were responsible for the production of rosickyite (gamma-sulfur) through the oxidation of thiosulfate to sulfate. Isolation of anaerobic strains was achieved using selective media containing thiosulfate as an electron donor and a headspace with either nitrogen or nitrous oxide gas. The genus-level identity of isolated strains was confirmed through 16S rRNA gene Illumina sequencing. Oxidation of thiosulfate to sulfate was tracked in cultures using a sulfate assay. Presence of rosickyite was tested by sulfur isotope analysis using X-ray Powder Diffraction and scanning electron microscopy Energy-Dispersive X-ray. Further analyses need to be run to confirm that the isolated strains are capable of rosickyite production through thiosulfate oxidation. Rosickyite is a rare form of sulfur that is known to be short-lived in the environment and biologically produced, making it an excellent biomarker in the search for extraterrestrial life. We anticipate that the results of this work will tell us which microorganisms and metabolic pathways are involved in the production of rosickyite, allowing us to better track this mineral in the environment.
SESSION G

LIFE SCIENCES POSTER PRESENTATIONS
The genus “Planoflexus” is the first cultivated member of a novel class of Chloroflexi, previously known as the TK-10/TK-17 phylogenetic cluster, which is present in both terrestrial and marine systems globally. Given its novel status, our goal was to expand our understanding of its metabolism through genome-guided cultivation experiments. Kyoto Encyclopedia of Genes and Genomes (KEGG) pathways were reconstructed for “Planoflexus thermophilus” G233 and “Planoflexus flavus” YIM 72310 using Ghost-KOALA and possible metabolic pathways were identified manually and by using Metabolic and Physiological Potential Evaluator (MAPLE). Subsequently, predicted metabolisms were tested in laboratory pure cultures. Although a variety of sugars and organic acids were predicted to serve as carbon sources, only acetate stimulated growth on complex medium, and no single organic compound supported growth. Both strains grew optimally with 21% to 5% oxygen and were unable to grow under anaerobic conditions by fermentation. Arsenate was used as a terminal electron acceptor for anaerobic growth; both were unable to grow with nitrite as a terminal electron acceptor strains, despite the presence of a putative nirK gene. These results show that “Planoflexus” is a facultative anaerobe with complex nutritional requirements. The stimulation of growth with acetate suggests use of the glyoxylate pathway for anabolism and suggests a role for “Planoflexus” in scavenging fermentation products in complex microbial communities.
Landscape Genetics of Orthopoxvirus vector, Apodemus

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Field mice, genus *Apodemus*, are common and broadly distributed across Eurasia, typically found in grasslands, forests, and mountainous areas. They are known vectors for *Orthopoxvirus*. In this study, we examine the population genetics of *Apodemus* within the country of Georgia. We sequenced the D loop region of mitochondrial DNA for individuals across a potential biogeographic barrier, the Likhi Range, which separates the country into a western Mediterranean climate and drier eastern basin. We investigate population structure using standard population genetic statistics such as Fst, AMOVA, nucleotide diversity, and isolation with migration. The population genetics of *Apodemus* will be examined in terms of their role as a vector for *Orthopoxvirus*. Future plans include comparing the population genetics for different species of Apodemus in order to analyze the effects of biogeographic barriers and climate differences on the transmittance of *Orthopoxvirus*. This can lead to a better understanding of zoonotic disease transmission in the area to aid in epidemiological studies.

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Bacteriophages are viruses that target specific strains of bacteria, and have the potential of being used solely or in combination with antibiotics to treat infections incited by multidrug resistant bacteria. The *Mycobacterium smegmatis* phages NihilNomen and Carlyle were isolated by undergraduates in Biol 207X Phage Discovery, a classroom based research experience. The temperate phages were isolated from compost from the University Campus Community Garden. NihilNomen’s genome has a 60.8% GC content (110,439 bp; 240 genes), and is representative of cluster J *Mycobacterium* phages. Genome annotation revealed notable genes including a putative third terminase subunit (gp2) upstream of the large and small subunits, a DD-transpeptidase corresponding with a pbp-beta lactamase domain protein (gp39), a putative immunity repressor (gp196) and a tRNA. Carlyle is a typical *Mycobacterium* cluster A1 phage with 63.6% GC content (51,220 bp) with 91 genes, but lacks a tRNA. There was a population of uncommon reads around position 29,100, indicating a possible mixture of two closely related phages, or that there is a large mutant population in the sample. In Carlyle, the small terminase (gp4) is not adjacent to the large terminase (gp13), lysin A (gp11) and lysin B (gp12) are located in between these two genes. Carlyle also contains a DD-transpeptidase (gp34), with 60% amino acid sequence identity with the DD-transpeptidase in NihilNomen, as well as a putative immunity protein (gp74) with a 98% amino acid sequence identity with that in NihilNomen. Proof of principle experiments are planned involving the highlighted unique genes.
Insights into the Type III Secretion System in Shigella Flexneri: An Investigation of how Mxie, an Activator of Type III Secretion System Effector Proteins, is Transcriptionally Regulated

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[Abstract withheld.]
It is well-known that the Mfd factor affects the production of mutations in stationary phase Bacillus subtilis. This Mfd-dependent effect on stationary-phase mutagenesis operates via its interactions with the RNAP, components of DNA repair systems, and error-prone DNA synthesis. However, recent evidence suggests that Mfd affects bacterial cell physiology beyond DNA repair. We showed that Mfd protects against protein oxidation, and we speculate this phenomenon proceeds by influencing expression of factors activated during such conditions. Furthermore, RNA-seq results indicate Mfd to be important for regulation of almost 2000 genes. This study seeks to further characterize the protective role of Mfd during protein oxidation. Mfd deficient cells will be coupled with inactivation of genes active during exposure to reactive oxygen species (ROS) (yfhD and fldP), H2O2 (bstA and ohrB), and DNA damage (polYB, uvsE and yoxB). The oxidant diamide, which produces the oxidation of thiols, will be used to induce the oxidative stress in stationary phase growth of B. subtilis. Competence and transformation protocols will be used to develop single gene knockouts (bstA, fldP ohrB, polYB, uvsE, yfhD, and yoxB) and double inactivation of these genes coupled with mfd deficiency. These mutants, along with wild-type B. subtilis and singularly mfd-deficient cells will be subjected to diamide-directed oxidative stress. Results and implications will be discussed.
Alzheimer’s Disease (AD) is a neurodegenerative disorder in which neurons (brain cells) lose their integrity and communication with other neurons. This characterization is caused by the two hallmarks of AD: neurofibrillary tangles composed of hyperphosphorylated tau protein and amyloid-beta plaques. However, another risk factor that has emerged is a chronically activated immune response in the brain (neuroinflammation). Several studies have demonstrated that chronic neuroinflammation exacerbates Aβ and ptau pathology. The exact cause of AD remains unknown; however, several risk factors exist that greatly increase the likelihood of developing AD. Several genetic risk factors increase the likelihood of developing AD; however, non-genetic risk factors also exist including age, cardiovascular disease, obesity, and diabetes mellitus (DM). Individuals with DM express high levels of glucose in the vasculature (hyperglycemia). DM confers up to a 4-fold increase in risk that arises based on hyperglycemia, insulin receptor resistance, and changes in the vasculature. Furthermore, 80% of individuals with AD have (DM) or are insulin resistance. We have previously demonstrated that intermittent administration of streptozotocin (STZ), induces sustained hyperglycemia in an otherwise healthy animal. STZ mice exhibit learning and memory deficits, increased ptau, and neuroinflammation. In AD, there is a general loss of γ-aminobutyric acid (GABA), thus, in the present study we investigated these same measures in a novel GABAB knockout mouse model of male and female mice over a year old since. Our data thus far indicate altered fasting blood glucose, and differences between males and females in response to the STZ administration.
Thymosin Beta-4 augments 5-Fluorouracil anti-proliferative effects in the DU145 Human Prostate Cancer Cell Line

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Thymosin beta 4 (Tβ4), a 43 amino acid peptide, is a biological response modifier characterized by the ability to regulate immune responses and partake in regeneration and repair of injured tissues. 5-Fluorouracil (5-FU) is a chemotherapeutic cytotoxic agent that is used to treat certain cancers, but causes serious side effects. Due to the anti-proliferative effects and low-toxicity of Tβ4, it is a potential candidate for use in conjunction with 5-FU to lessen its adverse side effects. DU145, a human prostate carcinoma cell line, was cultured in MEM supplemented with 10% FBS and 25mM HEPES in a humidified environment at 37 °C and 5% CO2 for 48 hours until 50% confluence. Varying concentrations of Tβ4 and 5-FU were prepared in culture medium and utilized to treat the cells for 48 hours. Pre-treatment time was four hours. Cells were stained with propidium iodide. Cell cycle progression was analyzed via flow cytometry. Cell proliferation was initially analyzed using an MTS assay. The flasks treated with Tβ4 had an increase in G2 phase cells and no increase in G1, S, and sub-G1 when compared to control. The flasks treated with 5-FU had an increase in cells in S and sub-G1 phases and a decrease in cells in G1 and G2 when compared to the control. The pre-treatment + co-treatment Tβ4 samples exhibited an increase in the percentage of cells in G1, S, and sub-G1 phase when compared to the control indicating an increase in apoptosis and potentially a cell cycle block.
Transposon Expression Levels Associated with Age-Related Macular Degeneration

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Transposons, sequences that can move horizontally and vertically through the human genome, have been shown to be dysregulated in several neurodegenerative disease models. Age-related macular degeneration (AMD) is a late-onset, neurodegenerative retinal disease that shares several clinical and pathological features with other neurodegenerative diseases. We hypothesized that transposons will be over-expressed in late stage AMD. We quantified transposon derived transcripts in 453 RNA-seq samples of cases (mgs level 4) and controls (Ratnapriya et al., 2019). We determined that transposons were not globally overexpressed in the later stages of macular degeneration. We found several specific transposon loci, and genes that were differentially expressed in the stage 4 macular degeneration compared to controls. Future research will realign the transposons and run differential alternative splicing analysis to determine whether the difference in transposon-derived transcripts are due to alternative splicing.
Histaminergic neurons in the tuberomammillary nucleus (TMN) of the hypothalamus form a broadly projecting, wake-active network that sustains arousal. Most histaminergic neurons found in the TMN region contain γ-aminobutyric acid (GABA), which is the primary inhibitory neurotransmitter in the brain. The GABA and histamine TMN components work together to regulate the amount of wakefulness. Antihistamines block the action of histamines via antagonism at the H1 receptor. Diphenhydramine, an antihistamine widely known by the brand name Benadryl, is a popular over-the-counter medication used to treat allergies with sedative effects. Many drugs that positively modulate GABA receptors also cause sedation. To better understand the role of GABA in modulating the histaminergic system, we administered diphenhydramine to mice with a mutation in the GABAA receptor α2 subunit (Gabra2-1 mice) before placing them in the behavioral open field test (OFT). The mutation in the Gabra2-1 mouse results in a loss of α2 subunit expression at the axon initial segment of neurons. Thus, implicating an increase in histaminergic neurons firing properties and therefore increasing sedation. Compared to wildtype controls, Gabra2-1 mutants travelled less in the OFT and spent more time immobile. Our results suggest that antihistamines preferentially elevate sedation-like behavior for Gabra2-1 animals in the OFT, revealing an interaction between GABAA receptor α2 signaling and histaminergic signaling. These studies advance our understanding of the mechanisms by which GABA and histamine signaling work together to control wakefulness and impact sleep.
In 2018, the World Health Organization (WHO) identified tuberculosis infection as one of the top ten causes for death globally. The causative agent for tuberculosis is Mycobacterium tuberculosis, which is commonly found in the lungs of infected individuals. Some TB can be treated and cured with four antimicrobial drugs in conjunction with proper healthcare supervision. However, there are multidrug-resistant tuberculosis (MDR-TB) strains, that have arisen from improper use of antibiotics. One way to potentially combat the issue of MDR-TB strains is the use of phage therapy. Phage therapy uses a bacteriophage (virus) to selectively target and kill bacteria. To that end, the SEA-PHAGE program is curating a bacteriophage library that may provide insights on how to effectively target multi-drug resistant bacteria. This program allows undergraduate researchers to discover and characterize novel environmental bacteriophages using a non-pathogenic host, Mycobacterium smegmatis. Mycobacterium smegmatis is a cousin strain of Mycobacterium tuberculosis, which allows undergraduate researchers to manipulate and study phages in this model host since it falls under a Biosafety Level 1 category. A four-step model of isolation, purification, amplification, and DNA extraction was conducted to obtain the bacteriophage, Aloha702. Following DNA extraction, gel electrophoresis was performed to determine genomic DNA size and quality. In addition, nanodrop analysis was performed to determine genomic DNA concentration and purity. Concentrated, high quality Aloha702 genomic DNA was sent for sequencing. In the future, we will annotate this genome and submit it to the SEA-Phage database.
Method for Detecting Emerging Contaminants in the Environment

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Emerging contaminants (ECs) are classified as any synthetic or naturally occurring compounds in the environment that are not commonly monitored and have the potential to cause adverse human health and ecological effects (Wilkinson et al., 2016; Raghav et al., 2013; United States Geological Survey, 2014). The following metabolites, 11-nor-9-carboxy-tetrahydrocannabinol (THC-COOH), benzoylecgonine (BE), amphetamine (AMP) and 3,4-methylenedioxyamphetamine (MDA) are ECs that contain physiochemical similarities with known pharmaceutical contaminants and pose similar breakthrough concerns in water treatment systems (Castiglioni et al., 2011). The objective of this project is to develop a novel method of detecting these metabolites in surface and wastewaters. This project included collecting water samples in triplicate from the Las Vegas Wash at the Pabco Road Water Weir. Samples were subjected to solid-phase extraction (SPE) to extract trace quantities of THC-COOH, BE, AMP and MDA. The extracted samples were derivatized with N,O Bis(trimethylsilyl)trifluoroacetamide (BSTFA) and trifluoroacetic anhydride (TFAA) followed by gas chromatography-mass spectrometry (GCMS) analysis. Metabolites were identified by comparing their retention time and mass spectrum to reference standards. Additionally, the National Institute of Standards and Technology (NIST) mass spectral search program with the NIST 05 library was utilized for confirmation. This assay has been successfully utilized to extract THC-COOH, BE, AMP, and MDA reference standards from spiked water samples and correctly identified via GCMS. Collective evidence reviewed in the preceding information strongly supports the conclusion that this method can be utilized to identify and monitor emerging contaminants. Results were pending at time of abstract submission.
Microscopic organisms were an essential component in forming earth’s early geological landscapes and can provide insight to earth’s modern biosphere. Sulfate-reducing microorganisms such as Desulfovibrio hydrothermalis (Dh) are involved in the formation of iron sulfide minerals through mineral encrustation. Iron sulfide minerals are therefore tightly connected to microbial compounds of the cell surface. We propose that strong organo-mineral interactions promote organic carbon preservation in anoxic environments. Glassware is rinsed with 1N HCl, washed with Alconox soap and tap water, and finally rinsed with distilled water. Blue stoppers are boiled three times in ultrapure water. All medium preparation, experiments, and TOC sampling were completed in an anaerobic glovebox. The final medium contained (1) Solution A, consisting of different minerals to resemble deep marine environments, (2) sodium bicarbonate buffer, (3) vitamin solution, and (4) trace element solution. All components were prepared separately under sterile conditions and mixed into a 2-Liter schotte bottle. In iron sulfide experiments, we compared the minerals produced by abiotic and biotic conditions. Biomineralization experiments test how the amount of lactate influences the amount of organic-carbon found attached to minerals. For both, abiotic experiments were filled with 1 milliliter of sulfide and biotic experiments were inoculated with 250 microliters of Dh. To prepare experiments for TOC sampling, they are transferred from serum vials to tubes, centrifuged at 8,000 rpm, resuspended with anoxic water, and transferred to 2 milliliter tubes. They are centrifuged again in the glovebox and left to dry. Results are still in progress.
Synthesis of Cisplatin Analog as Antineoplastic Drug for Cancer Cell Treatment

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According to the national cancer institute there is an estimated 1,735,350 new cases of cancer diagnosed in the United States as well as 609,000 deaths from cancer in 2018 (cancer.gov). One treatment for cancer involves the use of cisplatin, which was approved by the US Food and Drug Administration (FDA) in 1978. One of the negative side effects involved with cisplatin is that the induction of cell death is not selective to cancer cells alone, thus causing healthy non-cancerous cell death. To overcome the problems associated with cisplatin, we targeted to synthesize a cisplatin analog, which is a Pt (II) complex based on an ester ligand prepared from 2,2'-bipyridyl- 4,4'-diol (BD) and hexanoyl chloride (HC). The ester ligand was prepared successfully by carrying out the reaction of BD with HC in methylene chloride in presence of triethylamine for 24 h at room temperature. It was purified by washing with cold acetone and checked its purity from the analysis of proton (1H) nuclear magnetic resonance (NMR) spectrum. The synthesis of Pt (II) complex with this ester ligand and its characterization by experimental techniques including melting point, thermogravimetric analysis, differential scanning calorimetry, and elemental analysis are in progress. Further studies of this cisplatin analog will include in vitro testing of different cancer cell lines to determine validity of this compound in antineoplastic cancer cell treatment.
Examination of Alzheimer's Disease-related Pathology as a Result of Hyperglycemia in Young Versus Aged Mice

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Alzheimer's Disease (AD) is a neurodegenerative disorder characterized by cerebral atrophy and learning and memory deficits. Neurofibrillary tangles composed of hyperphosphorylated tau and amyloid beta (Aβ) plaques are two of the biological features used in the neuropathological diagnosis of AD. A third emerging characteristic of AD is chronic inflammation due to a buildup of activated microglia. Research demonstrates that chronic inflammation worsens Aβ and ptau pathology. Although there is no known cause of AD, there are several risk factors that increase the probability of developing AD. The probability of developing AD is also increased through non-genetic factors including diabetes mellitus (DM), which is characterized by hyperglycemia and insulin receptor resistance. Research suggests there is a likely link between DM and age associated risk for AD. Prior research demonstrates that the administration of streptozotocin (STZ) in a mouse model induces sustained hyperglycemia. Mice with STZ demonstrate learning and memory impairments, inflammation in the brain, and increased phosphorylated tau. This investigation inspects these same measures in seven-month-old versus twelve-month-old wild-type mice and looks at the effects of STZ in young vs. aged mice.
Burkholderia pseudomallei, the causative agent of the dangerous disease melioidosis, is contracted from the environment, where it resides in bacterial communities called biofilms. Because B. pseudomallei is a biosafety level 3 organism, Burkholderia thailandensis, a close genetic relative that is non-pathogenic and is a model biofilm organism, is used to study the environmental biofilm lifestyle of this human pathogen. A major component of the biofilm is the extracellular polysaccharides that help hold the resident bacteria together. The B. thailandensis biofilm has been previously characterized to have four exopolysaccharides (EPS). While the biosynthetic genes for these EPS have been identified, it is not clear what the sugar composition of each is. Our previous work in B. thailandensis identified four sugar-binding proteins, called lectins, that interact with the B. thailandensis biofilm. Here we will characterize the sugars in each EPS by forming biofilms under flow and correlating the binding of these lectins with the deletion of EPS I-IV biosynthetic gene clusters. Preliminary data suggests that EPS I and II gene clusters might have an additive effect on the production of the sugars, mannose and fucose. By further understanding the sugars in each matrix EPS, we get a better understanding of the biofilms formed by this group of Burkholderia in the environment.
[Title Withheld.]

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[Abstract withheld.]
The Role of *mfd* in Biofilm Formation and DNA Repair in *Pseudomonas aeruginosa*

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*Pseudomonas aeruginosa* is an opportunistic pathogen that is a common cause of nosocomial infections. Key to the pathogenesis of *P. aeruginosa* is its ability to form biofilms, which are communities of bacteria held together by a self-produced matrix. The formation of biofilms relies on numerous genes. While many *P. aeruginosa* biofilm-related genes have been characterized, there are genes with established connections to biofilm formation in other bacteria that have yet to be characterized in *P. aeruginosa*. For instance, while mutants of *mfd* (mutation frequency decline) in *Staphylococcus aureus* have been shown to be defective in biofilm formation, the role of the gene in *P. aeruginosa* biofilms has not been examined. Here, we characterize the role of *mfd* in *P. aeruginosa* biofilm formation and DNA repair. We generated a *P. aeruginosa* strain lacking the *mfd* gene and quantified the effects of this mutation on biofilm formation and DNA repair via a static biofilm assay and ultraviolet radiation assay, respectively. Our preliminary results show that compared to wild type *P. aeruginosa*, the *mfd* deletion strain forms about 20% the biofilm biomass and is impaired for DNA repair. Further studies are needed to understand the mechanisms underlying the role of *mfd* in both processes.
Investigating the Effects of Post-Translational Modification on Virulence Gene Regulation in the Bacterial Pathogen Shigella flexneri

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[Abstract withheld.]
We would like to thank everyone who contributed to this event. Without your contributions, recognition of the efforts of undergraduate researchers would not have been possible.

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