



*University of Wyoming  
April 26 and 27 2019*

## Student Abstracts

Oral Presentations: Classroom Building, Engineering  
Education and Research Building  
University of Wyoming Campus  
Friday April, 26 1:00 - 6:00 pm  
Saturday April 27, 8:00 am - 12 pm & 3:00 - 5:00 pm

Poster Presentations: Family Room,  
Wyoming Student Union  
Saturday, April 27 1:00 - 3:00 pm

## ACKNOWLEDGEMENTS

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## **Production of Ethylene through the Oxidative Dehydrogenation of Ethane using Carbon Dioxide**

Faiz Ahmed, Travis Curry (Team Lead), Coleton Kinney

Dr. David Bell

University of Wyoming

An industrial-scale use for carbon dioxide for reducing/ mitigating greenhouse gas emissions is desired. We will use catalytic oxidative dehydrogenation (ODE) of ethane into ethylene using carbon dioxide. The process involves reacting ethane and carbon dioxide at 650 °C and then separating the reactants from the product and by-products (carbon monoxide and water). Water is condensed out while carbon monoxide is separated using a membrane. The ethane and ethylene are then separated through cryogenic distillation yielding a 99% pure ethylene product (with 99% recovery). The ethane is recycled back to ensure all carbon dioxide is consumed. Due to extreme temperature swing in operating conditions throughout the process, 650 °C in the reactor to -65 °C in the distillation tower, a heavy emphasis is put in the optimization of energy transfer to minimize energy costs and resulting emissions. An emissions/economic analysis will be performed to determine if the process is both economically feasible and adheres to the project intent of reducing overall carbon dioxide emissions. A HAZOP study has been performed on the base case process. The variants of the base process will be tested (including reaction temperature and auxiliary sub-processes) and an economic and emission analysis will be performed to determine feasibility. The HAZOP for the base process will be adjusted/modified as necessary to the variant processes.

## **Site-Directed Mutagenesis of Nociceptive TRPV1/TRPA1 to study Pain Signaling**

Hanna Ahuja with Dr. Baskaran Thyagarajan

Department of Pharmacy

University of Wyoming

Poster Presentation

*INBRE, WRSP*

*Rock Springs, WY*

The molecular mechanism of nociception by Transient Receptor Potential (TRP) Vanilloid 1 (TRPV1) and TRP Ankyrin 1 (TRPA1) channels have been studied. Common to all TRP channels are tetramers, with each subunit containing six transmembrane domains and intracellular amino and carboxyl termini. As a polymodal receptor, TRPV1 is activated by various exogenous and endogenous stimuli such as the vanilloid capsaicin, heat, protons, and endocannabinoid anandamide. TRPA1 is activated by stimuli, including electrophilic chemicals, cold temperature, and mechanical force. However, the molecular mechanism of TRPV1/TRPA1 activation and pain sensitization remain unclear. Functionally, the phosphorylated and dephosphorylated states of TRPV1/TRPA1 are linked in pain sensitization mechanisms. Cellular protein kinases including protein kinase C (PKC), protein kinase A (PKA), calcium/calmodulin activated protein kinase II (CaMKII) and protease activates receptor 2 (PAR-2) sensitize nociceptive TRP channels. Hence, a structure-function approach was taken to investigate the role of phosphorylation of these two proteins. We identified the putative phosphorylated serine, threonine, and tyrosine residues by alignment of different mammalian TRPV1/TRPA1 sequences and determined the highly conserved residues among these sequences. Alanine scanning mutagenesis in TRPV1 indicates that S502 and S800 are two potential sites that undergo phosphorylation by PKC. Exceptions are mutations in TRPA1 – S341 and S759 whose phosphorylation status was not affected by PKC activation. Further work is in progress to find the sites phosphorylated by other cellular kinases. Our structural and mutational results provide new insights in TRPV1/TRPA1 phosphorylation and their role in pain sensitization mechanisms.

## **Cat Canyon Reservoir Characterization and Borehole Design Topwell Petroleum**

Thamer Alghamdi, Paco Chirakorn, Stephen Nash (Team Lead), Noah Sherlock, Kevin Tuliao

Topwell Petroleum has chosen to take on the Cat Canyon Reservoir Characterization and Borehole Design Project as part of our 2019 developmental plans. This presentation will focus on one of the largest oil fields in Santa Barbara County, California; the Cat Canyon Oil Field, which is currently being exploited through thermal Enhanced Oil Recovery operations. Using existing reservoir data and Enhanced Oil Recovery methods, Topwell Petroleum has developed a three-dimensional model of said reservoir and subsequently determined the optimal location for a new horizontal borehole. The static reservoir model was created using Schlumberger's Exploration & Production software suite; more specifically, Petrel. Significant error was introduced to the reservoir model due to data insufficiency and inconsistency, specifically, a lack of a complete well log suite and downhole geological markers. This required incredible amounts of data interpretation to occur throughout the research stage. After considering the Cyclic Steam Stimulation conditions of the field an ideal horizontal wellbore design is to be constructed. The wellbore model was developed along with well spacing and a drilling program through PIPESIM software. A production analysis through IHS Harmony was performed on every provided well in each lease. The most productive formation and lease location was determined by the production analysis of offset wells, giving an ideal location for the new wells. The Cat Canyon Reservoir Characterization and Borehole Design Project presentation will address the implantation of horizontal wells in the field. The scope of the presentation includes methods to enhance the performance of the Cyclic Steam Stimulation designed for the horizontal wells.

## **Wastewater Reuse and Management in India**

Yousef Almalek and Claire Sebald with Tabassum Mustary and Ramesh Sivanpillai  
Environmental Science and Natural Resources  
University of Wyoming  
Oral PowerPoint Presentation

*Environmental Science and Natural Resources*

*Laramie, WY*

People in India are suffering from water pollution in many cities, from different water pollution sources. Researching and studying why people still suffering from this issue is a first important step to solve the issue of water pollution that is affecting the environmental life in these cities. Our research pertains to the policy and management of the wastewater reuse plans in India. As well as the policy development/education on reused water throughout the area of study. Not only that, but also at the end of the research finding solutions will be one of the main achievements of it. Finding solutions from other cities or comparing to other countries with similar issues on how they treat it will be supporting our research to find a better solution.

## **Flash Pyrolysis of Coal in an Atmosphere of Methane**

Cody Anderson, Chris Demars, Alex Hardy, Brett Peterson, and Justin Kostelecky  
with John Myers  
Chemical Engineering  
University of Wyoming  
Oral Presentation

*Honors*

*Cheyenne, WY*

For this process, coal is flash pyrolyzed in an atmosphere of methane at 1832°F and 500 psi. In order to maximize useful products from this process, the residence time within the reactor must be less than one second and the product stream must be immediately quenched with a water stream to cool the products to 400°F. Higher residence times allow undesirable reactions to take place. The most valuable products from this process are benzene, toluene, xylene, and ethylene. Several steps must be taken to purify these products. However, in this process, ethylene is not purified from the other components. The first stage of separation is a filter used to remove the char that remains in the stream after the reactor. This char is combusted to heat the reactor. The resulting stream is then cooled before being fed to a flash drum to remove as much water as possible. The gaseous stream from the flash drum is then fed to a cryogenic turboexpander to condense the benzene, toluene, and xylene while leaving the other components from the reactor in the gaseous phase. The benzene, toluene, and xylene are then purified further in a centrifugal decanter.

## **Microplastics in Snow and Water: Dryer Vents as a Source of Microplastic Pollution and Using Nile Red to Identify Microplastics in Tap Water**

Zach Andres with Professor Kirsten Kapp  
Central Wyoming College  
Oral and Poster Presentation

*INBRE*

*Jackson, WY*

The pervasiveness of microplastics (MPs) in our environment has been confirmed in an increasing variety of landscapes and are raising concern as they may cause detrimental harm to a variety of organisms. One avenue that MP fibers enter the environment is through washing machine effluent from laundered synthetic clothing. This study focuses on a less studied source of anthropogenic MP fibers, laundry dryer vents. The goal of this study is to quantify the amount of MP fibers released from dryer vents, to determine the distance MP fibers travel once released from the vents, and to measure the abundance of MP in tap water in Jackson, Wyoming. Snow samples were gathered at several different laundry vent sites and were taken from 5', 10', and 15' increments from the vent. Snow samples were collected from a 1 ft<sup>2</sup> area, scraping layer upon layer of snow, and deposited into a mason jar (1500mL) until full. Melted amounts of snow equated to 550-650 mL, depending on snow-water equivalent. Water samples (500mL) were collected from various taps, both on municipal water supply and well water. Snow samples were filtered with a 0.45µm filter and visually inspected under a stereoscope (SMZ800N with magnification 15x-120x). MP fibers were identified if they met visual criteria. Tap water samples were dyed with Nile Red, filtered with a 0.45µm filter, and inspected under a stereoscope with a fluorescence adapter (NIGHTSEA®). MP were identified if they adsorbed Nile Red and fluoresced under a blue light with orange filter.

**Genome-Wide Screen for Client Proteins of the PopZ Cell Pole Scaffolding Protein, in *Agrobacterium tumefaciens*.**

Carrie Anglemeyer  
Grant Bowman Molecular Biology Department  
University of Wyoming  
Poster Presentation

*McNair Scholars*

*Millersburg, IN*

Bacterial cells display a wide variety of morphological structures, indicating there is functional organization within the cell. Difficulties lie in finding which proteins are at what locations in the cell and which molecular mechanisms are responsible for bringing these proteins together. My research will fill gaps in understanding interactions of a cell pole scaffolding protein, PopZ, within *Agrobacterium tumefaciens*, a pathogenic species of Alphaproteobacteria. Due to PopZ's unique nature, it has many binding partner proteins that it recruits during cell pole organization. PopZ is categorized as an intrinsically disordered protein, similar to the eukaryotic p53 tumor suppressor protein domain. In *Agrobacterium*, PopZ's interconnectedness makes it a "signaling hub" that is critical for cell organization. To understand these interactions my project has three specific aims: 1. Development of a high efficiency method for identifying PopZ interaction partners through blue / white bacterial colony screening 2. Identify binding partner proteins by DNA sequencing 3. Confirm interaction of binding partner proteins through a secondary method. The long-term goal of this project is to successfully repeat this new method to currently unculturable bacteria such as obligate intracellular pathogens. By comparing PopZ interaction networks in multiple organisms, this study will explore evolutionary change in intrinsically disordered proteins, and address questions about their functional capability in all kingdoms of life.

**The Combined Wind and Ice Accretion Hazard for Wyoming**

Yara Anis  
University of Wyoming

*Architectural Engineering*

Wyoming produces a huge amount of electric energy because of its windy weather. However, when the wind velocity is higher than the power tower strength capacity this would lead to structural failures. In Wyoming, not only the wind loads that would form a risk on structure failures, but also the snow loads. Previously, a traditional analysis was approached by studying each risk, snow and wind, independently. However, when both risks are combined, huge damages occur causing a waste of a lot of time and money. In this Report, Precedent cases are studied to approach new improvements suitable for being applied on Wyoming Power Transmission lines. These improvements would help in upgrading power towers by minimizing the outage times, so that Wyoming transmission lines would be structurally and economically more efficient.

## **I've Got 99 Problems, but BPA Ain't One**

Victor Anthony, Alexander Brown, Shavinka Fernando, Jake Koney, and Mike Trbovich

United States Environmental Protection Agency (US EPA) standards require oil refiners to remove benzene from gasoline before sale to reduce impacts of chemicals. Benzene is a carcinogen and is limited to roughly 2% by volume by the EPA. Fracking technology is increasing in the United States, flooding the market with large amounts of propylene. These two chemicals, used as feedstocks, can be utilized to create BPA. The goal of this project is to design an industrial plant that produces approximately 150,000 pounds of Bisphenol-A (BPA) per year. Due to the necessity of oil and gas by-products and high population of refineries, the facility's location is in the Gulf Coast. This plant's overall scope appears in two stages. Stage one was to design a plant that produced acetone and phenol from benzene and propylene through the production of cumene. Stage one determined the economic feasibility. Stage two extends the design with two scenarios. Stage two, Scenario A describes a plant producing BPA using produced phenol and selling excess acetone. Stage two Scenario B describes a plant producing BPA using produced acetone and purchasing excess phenol, as needed. BPA products require high purity; thus, the produced BPA will be approximately 99% pure. This approach allows for maximum BPA sales and an opportunity to cater to the producers of polycarbonate plastics. Design and economic recommendations were made depending on the economic feasibility and efficiency of each individual section of the plant.

### **Comparing Establishment Methods Among Difficult to Produce Native Plant Materials**

Jaycie Arndt, Faculty Mentor: Brian Mealor

Plant Sciences

University of Wyoming

Oral Presentation

*Arvada, WY*

Some native species are highly desirable in reclamation and restoration settings, but seed availability is limited because the species is challenging to effectively establish, grow, harvest, clean, and condition. Additionally, propagation methods may directly impact native plant restoration efforts where original seed sources are limited. We evaluated methods for seed increase of native plants sulfur-flower buckwheat (*Eriogonum umbellatum* Torr.), desert biscuitroot (*Lomatium foeniculaceum* J.M. Coult. & Rose), and Letterman's needlegrass (*Achnatherum lettermanii* (Vasey) Barkworth). Sulfur-flower Buckwheat is a native, low growing, woody mat-forming perennial that is important for quail, sage-grouse, and ungulate forage, and for pollinator habitat. Desert biscuitroot is a broad-leaved, herbaceous perennial of the Apiaceae. It is used for medicinal purposes and is an important forage for sage grouse. Letterman's needlegrass is a native, cool season, perennial bunchgrass. It remains green through a long growing season and provides valuable forage for wildlife and livestock. We compared establishment and survival between direct-seeding and transplanting containerized seedlings for seed production fields in northeast Wyoming. Sulfur-flower buckwheat establishment was 71.7% +/- 21% (95% CI) with transplanting and a 0.18% establishment rate with direct seeding. Desert biscuitroot establishment was 18.1% +/- 19.3% (95% CI) establishment rate with transplanting and a 10.2% +/- 1.5% (95% CI) establishment rate with direct seeding. Letterman's needlegrass establishment was 33.3% +/- 22.1% (95% CI) rate with transplanting. Direct seeding survival of letterman's needlegrass will be evaluated in the future as well as survival, seed production, and seed quality for all species.

## Understanding iron regulation of *Toxoplasma gondii* dissemination during acute infection

Allison Arp and Dr. Jason P. Gigley  
Department of Molecular Biology  
University of Wyoming  
Poster and Oral Presentation

*INBRE, Honors*

*Cheyenne, WY*

*Toxoplasma gondii* (*T. gondii*) is a highly prevalent protozoan present in 30% of people worldwide. This parasite is a health threat to developing fetuses and immunocompromised individuals. To date, there are no therapies or vaccines which provide thorough, sterilizing immunity to *T. gondii*. Understanding mechanisms that promote the success of this pathogen are important to develop novel therapeutics. *T. gondii* infection is controlled by the host via IFN $\gamma$ . IFN $\gamma$  is known to mediate nutrient starvation of the parasite, and, in particular, to limit the availability of iron. Iron is a vital cofactor sequestered by the parasite from the host within infected cells. Based upon published results from *in vitro* studies, iron sequestration from the host is thought to be essential for parasite growth and replication. However, our preliminary data indicates that, as opposed to lack of growth *in vitro*, continuous limitation via iron chelation with deferiprone dramatically increased chronic infection burden in mice. These conflicting results render the importance of iron in parasite dissemination *in vivo* unclear. To clarify said importance, we treated mice with deferiprone and compared acute infection parasite burdens in the spleen, liver, small intestine, brain, and lungs after 7 days of infection with either ME49 or RH parasite strains. Real time PCR analysis was performed on extracted tissue DNA. Our results will, for the first time, define how iron availability impacts parasite dissemination *in vivo* and lead to a better understanding of the pathogenesis of this infection for more rational therapy design.

## Cardiometabolic Alterations Following Spinal Cord Injury

Carson Asher with Dr. Bushman  
University of Wyoming: College of Health Sciences  
Poster/Oral Presentation

*INBRE*

*Powell, WY*

Spinal cord injury (SCI), while best known for its propensity to render certain muscle groups useless through disrupted neural signals, can also lead to less obvious, but often fatal, long-term health risks. A large portion of SCI victims have suffered from (i) pneumonia, (ii) segmental lung collapse, (iii) respiratory failure, and (iv) Type 2 Diabetes. Despite the known consequences of SCI, there is a hole in research concerning cardiometabolic and gender-dependent responses to SCI. We have conducted research on the acute effects of SCI on cardiometabolic functions in Sprague-Dawley rats. In addition, contrasts in response to SCI between male and female Sprague-Dawley rats were also observed. Rats were randomly assigned to either an SCI group or a sham (control) group. Cardiac structure and function were measured periodically using an echocardiogram to search for significant differences between SCI rats and the control group. Results from the echocardiogram showed significant differences found in left ventricular internal diameter (LVID), left ventricular ejection fraction (LVEF), and left ventricular fractional shortening (LVFS). Dual-energy X-ray absorptiometry (DEXA) was utilized to assess the body composition of the rats. From the results, SCI males experienced significant weight loss at weeks 8 and 12, but females did not. Intraperitoneal glucose tolerance tests (IPGTT) were performed monthly to analyze the rats' ability to metabolize glucose, although no significant differences were observed. Lastly, histological analysis and western blots were performed to look for markers of fibrosis at a molecular level.

## **Estrogen and Progesterone induce PAD activity at the murine CV mucosa**

Sarah E. Bailey, Dr. Brian Cherrington, Dr. Heather Rothfuss

Department of Zoology/Physiology

University of Wyoming

Poster Presentation

*INBRE*

*Laramie, WY*

Women are 3 times more likely to develop rheumatoid arthritis (RA), develop the disease earlier, and have poorer clinical outcomes than men. RA auto-immunity arises when citrullinated (cit) proteins generated at a mucosal surface by peptidyl arginine deiminases (PADs) stimulate the production of anti-cit protein antibodies (ACPA). Studies of non-reproductive mucosal sites have not explained the gender disparity of RA. Our collaborators have detected ACPA in cervico-vaginal fluid (CVF), suggesting the CV mucosa as a site of cit-protein formation and ACPA production. Parity, age of menarche, and birth control correlate with RA in females suggesting hormone involvement in the etiology of RA. Our previous research demonstrates that female reproductive hormones stimulate PAD expression and activity. Based on this, we hypothesize that reproductive hormone fluctuations drive PAD activity at the CV mucosa. We have used a mouse model to test the effects of hormones on PAD activity, and therefore cit antigen changes, in CVF. In CVF from pregnant and postpartum mice, PAD activity increases during mid-pregnancy when estrogen and progesterone levels are elevated. To determine the effect of each hormone, mice were ovariectomized and treated with vehicle, estrogen, progesterone, or estrogen and progesterone. CVF was collected and PAD activity assayed. We observed an increase in PAD activity with estrogen and estrogen plus progesterone treatment, but no change with progesterone alone. We are in the process of repeating this experiment with a larger cohort to accumulate samples sufficient for MS analysis of hormone induced CVF cit-protein antigens.

## **Formula Hybrid Safety Circuitry**

Chad Baker with Dr. Steven Barrett

Electrical Engineering

University of Wyoming

Oral and poster Presentation

*ECE/EE*

*Rock Springs, WY*

For Senior Design I was able to work on a project from the University of Wyoming's club Wyoming Motorsports. The goal of the club is to design, build and race a hybrid race car at the 2019 SAE formula hybrid competition. My individual project involves three circuits designed to safely operate the accumulator isolation relays (AIRs). A voltage pre-charge circuit will allow the motor controller to be charged to 90% of battery voltage, this will make the voltage difference very small when the AIRs close and therefore limit the inrush current. I have accomplished this by a second set of relays and an RC circuit. After roughly five seconds the pre-charge will be complete and the AIRs are ready to be closed. The second circuit is a discharge circuit. This will reduce the motor controller voltage to 0V after the AIRs open and it will be disconnected while pre-charging and in drive mode. To accomplish this, I used two normally closed relays, of these relays one is tied to the pre-charge signal, and the other is tied to the final drive signal. The last circuit is a shutdown circuit. This circuit will take a series of checks to ensure everything is working correctly before the AIRs are able to close. This circuit will include buttons which can open the circuit, relays controlled by the battery management system, as well as switches controlled by the driver.

## **Selection of an optimal invertebrate taxon for use as a baseline in stable isotope analyses of stream food webs.**

Nathan Barrus

Mentored by Dr. Frank Rahel and Bryan Maitland

Dept. of Zoology and Physiology

University of Wyoming

Oral Presentation

*Wyoming Research Scholars Program*

*Worland, WY*

Stable Isotope Analysis (SIA) uses ratios of stable isotopes of elements within tissues to infer diets of organisms. Because tissues replace cells at varying rates, SIA gives time integrated information of diets. Carbon ( $\delta^{13}\text{C}$ ) and nitrogen ( $\delta^{15}\text{N}$ ) isotopes help reconstruct food webs and understand trophic interactions. However, land-use changes can alter the  $\delta^{15}\text{N}$  signature and make it difficult to compare food webs across sites. Therefore, stable isotope signatures need to be corrected for differences in the  $\delta^{15}\text{N}$  signatures of basal food resources across sites. To address this, I will identify invertebrate(s) as a baseline for cross-site comparisons of isotope values based on four criteria: 1) wide geographic distribution, 2) low within-site  $\delta^{15}\text{N}$  variation, 3)  $\delta^{15}\text{N}$  baseline values are correlated with environmental  $\delta^{15}\text{N}$  values, and 4) trophic position predictions of other organisms that do not change when using the baseline. Benthic invertebrates from sixteen sites along major tributaries of the North Platte River were collected and identified to family and Functional Feeding Groups (FFGs). The samples were analyzed for stable isotope signatures. Preliminary results show that Baetidae mayflies (for a specific taxon) and Filterers (i.e., Simuliidae and Hydropsychidae) have low within-site  $\delta^{15}\text{N}$  variation and have  $\delta^{15}\text{N}$  values correlated with  $\delta^{15}\text{N}$  values in the environment. These groups are widely distributed among sample sites (83% and 100% of sites analyzed), indicating they would comprise ideal baselines for trophic stream studies.

## **What topics should we teach the parents of admitted neonates in the newborn care unit in the resource-limited setting. A Delphi Consensus study**

Batenhorst S. with Musabyemungu JA., Willson A., Webbe J., Cartledge P

Rwanda is a resource-limited setting with few nurses to neonate ratios, so caregivers provide a significant role in care for admitted neonates. In order to provide Family Integrated Care, caregivers need knowledge, skills and confidence. Therefore, parent education is an important part of neonatal care. However, teaching resources are limited so choosing the right topics to educate parents is important. This study aimed to identify consensus from key stakeholders regarding the priority topics for a “parental neonatal curriculum.” A three-round Delphi study was conducted. Stakeholders included parents, midwives, nurses and physicians. Round 1 included face-to-face interviews; responses were coded and categorized into themes. In Round 2, participants were presented with Round 1 feedback and asked to provide additional topics in the respective themes. In Round 3, respondents were asked to rank the importance of these items using a 1-9 point Likert scale. Consensus was gained from 10, 36 and 40 participants, in Rounds 1, 2 and 3 respectively. Twenty and 37 education topics were identified in Rounds 1 and 2 respectively. In Round 3 47 of the 57 presented topics met pre-defined criteria for inclusion in the “parental neonatal curriculum.” As we move beyond neonatal survival, aiming for a holistic approach to neonatal care, families should be optimally integrated into the care of their newborn. This requires appropriate education. Here we have described a “parental neonatal curriculum”, formed using robust consensus methods, that can be used during admission to guide the education of parents who are providing Family Integrated Care.

**CWC's Interdisciplinary Climate Change Expedition (ICCE):  
Measuring Water Quantity and Water Quality in the Dinwoody Cirque**

Marten Baur and Amanda Dyer  
with Professor Jacki Klancher  
Health and Science  
Central Wyoming College  
Oral and Poster Presentation

*INBRE, EPSCoR and NASA*

*Lander, WY*

Wyoming's Dinwoody Cirque displays evidence of numerous climate-related changes including recession of alpine glacial ice. Glaciers serve as a source of water after the season's snowpack is exhausted and are critical to supporting Wyoming's agricultural-based economy. This research's objective was to record and evaluate stream discharge and assess biological and chemical water quality. These topics have been studied over a series of years. Analysis of water samples (2016-2018) to assess presence/absence of *E. coli* — a bacterial indicator organism— revealed negative presence in all surface water samples. Measurement of Dinwoody Creek's total discharge revealed massive differences between 2017 and 2018 (1,580,256 m<sup>3</sup> and 5,519,938 m<sup>3</sup>, respectively). Data retrieved from the National Water Information System revealed the total discharge of Dinwoody Creek in August for 2017 and 2018 to be 21,541,840 m<sup>3</sup> and 20,785,853 m<sup>3</sup>, respectively. This indicates Dinwoody Creek glacial contribution percentages of 7.34 and 26.56 for 2017 and 2018, respectively. The growing percentage of glacial contribution to Dinwoody Creek calls to action further investigation of the climate-related changes occurring in the Dinwoody Cirque.

**Falling and Rolling as a Strategy to Reduce Lower Extremity Landing Forces**

Marten Baur, Taylor Kuehn, Ling Li, Jamie McMullen, and Yu Song  
with Professor Boyi Dai  
Kinesiology and Health Promotion  
University of Wyoming  
Oral and Poster Presentation

*INBRE, EPSCoR, and NASA*

*Laramie, WY*

One of the most common athletic knee injuries is the anterior cruciate ligament (ACL) tear, which can occur in non-contact jump-landing tasks. Safely falling and rolling can potentially reduce the risk of ACL injuries, for falling and rolling in parkour athletes has shown decreased knee loading upon landing. Five recreational athletes were tested so far, and each subject completed jump-landing tasks on force plates to measure knee loading. It was found that falling and rolling reduced vertical ground reaction forces when compared to normal landing. This indicates that falling and rolling may be used as a strategy to reduce the risk of ACL injuries. This information can be utilized by athletic coaches to help reduce sport-related ACL injuries.

## **Guillain-Barre' Syndrome: A Clinical Summary**

Hannah Belleau with Dr. Tonja Woods  
University of Wyoming School of Pharmacy  
Oral Presentation

*Honors College*

*Parker, CO*

Guillain-Barre' Syndrome is a neurological syndrome that impacts nearly 100,000 patients yearly. This disease is a severe neuropathy resulting in rapidly ascending paralysis. The presentation of Guillain-Barre' varies depending on the subtype and the region where it is contracted. Antecedent events for Guillain-Barre's Syndrome are not fully understood, but these are known to include bacterial or viral infections and rarely, immunizations. (Willison et al, 2016). Evidence suggests that molecular mimicry may be a component of antecedent event response, particularly in *Campylobacter jejuni* infections (Van Doorn, et al 2010). Pathophysiology of the condition differs between the axonal and demyelinating subtypes, as does length of recovery (Willison et al, 2016). Treatment is guideline-based and is centered around immunotherapy with either immune globulin administration or plasma exchange. (Hughes et al, 2003). Guillain-Barre' Syndrome presents a unique opportunity for pharmacists to educate patients and providers, lead evidence-based and patient-specific care, and to support patients in the recovery process through excellent symptoms management.

## **Binding Efficacy and Thermogenic Efficiency of Pungent and Nonpungent Analogs of Capsaicin**

Jane Bennis and Baskaran Thyagarajan  
School of Pharmacy  
University of Wyoming  
Poster

*INBRE*

*Fort Collins, CO*

Capsaicin (CAP) is a pungent capsaicinoid found in chili peppers which has previously been shown to reverse the effects of diet-induced obesity in mice via activation of Transient Receptor Potential Vanilloid Family 1 (TRPV1) through the enhancement of metabolism, energy expenditure, and browning of white adipose tissue (WAT). CAP and its nonpungent analogs activate TRPV1, however their efficiency in doing so remains unclear. Binding efficiency of capsaicin versus two nonpungent analogs, Capsiate and capsaicin- $\beta$ -d-glucopyranoside (CAP- $\beta$ -dgluco), was analyzed via molecular docking. Wild type mice were fed normal chow or high fat diet ( $\pm$  0.01% pungent or nonpungent capsaicin analog), after which mice were euthanized and inguinal WAT was isolated to analyze thermogenic gene and protein expression.  $Ca^{2+}$  influx in TRPV1 expressing HEK293 cells stimulated with CAP, Capsiate, and CAP- $\beta$ -dgluco was analyzed. CAP is anchored to the binding channel of TRPV1 by hydrogen bonds, which Capsiate lacks, and CAP- $\beta$ -dgluco binds outside of the binding channel. CAP and Capsiate produced an anti-obesity effect in mice, where CAP- $\beta$ -dgluco was ineffective. The protective ability of CAP was more effective than Capsiate. Expression of thermogenic genes was profoundly enhanced in CAP-fed mice. CAP-stimulated TRPV1-expressing cells produced more profound and sustained activation than nonpungent analogs. There is activation of TRPV1 and subsequent anti-obesity effects in CAP, Capsiate, and CAP- $\beta$ -dgluco, however the protective effect of CAP and sustenance of TRPV1 activation in CAP-conditions indicates it is the most effective potential pharmacological therapy for obesity.

## **Wyoming Politics: A Look into the Effects of Conservative Political Traditions**

Connor Bergman with Dr. Christopher Rothfuss

Social Work

University of Wyoming

Oral Presentation

*Honors*

*Casper, WY*

For most of Wyoming's statehood, Wyoming has been known as a conservative, Republican majority state. One of the core principles of conservatism is the value of tradition and the importance of sticking to the things that have always worked. That core value of tradition is transferable to other parts of Wyoming other than its moral values. As many voting Wyoming citizens subscribe to the value of tradition and conservative idealism, many voters also tend to vote in kind. This research seeks to determine Wyoming's relevance in political standing with the rest of the nation by comparing policies and political norms based on the understanding that Wyoming tends to value tradition and pursue consistency. In seeking to answer this question, this research will include interviews from nine members of the Wyoming Legislature from the House and the Senate, both Republican and Democrat, to gauge perspective on Wyoming's policy stances and whether we are ahead, behind or on par with the rest of the nation. The interviews will be conducted by a qualitative survey which will be given to each elected official. Background policy research will be included to determine Wyoming's current stance on each of these issues and whether our policy status is consistent with the opinion and expertise of our legislators. The findings generated by this research were predictable in areas like cannabis legalization and progressive political movements but surprising in some areas like carbon dioxide emissions, renewable energy, and educational funding provisions.

## **Wine Blender**

Tyler Bettolo with Vic Bershinsky

Electrical Engineering

University of Wyoming

Oral and Poster Presentation

*EE/ECE*

*Rock Springs, WY*

This abstract explains all the basic details of my Senior Project since deciding on the Wine Blender as my topic in the beginning of the semester. The Wine Blender is an automated system that will be able to take multiple blends of wine and mix them together for a new, user specified blend of wine. Thus far, I have done intense research on different approaches to completing my project, implemented that research into completing my project, started building the project. I have also talked extensively to engineers from the company that is funding my project for ideas, tips, and suggestions on how this prototype should be completed. The owner of Infinity Power and Controls, Bruce Pivic, and the funding source of this project, is who came to me with this idea. Automation has always been something I have been interested in pursuing after graduation so that is why I accepted the responsibility of making a working prototype for my Senior Project. So far, the components and process of completion I have decided on are promising and I am looking forward to completing and submitting this project to Bruce and the University for Undergraduate Research Day.

## **Evaluation of Role of Uncoupling Protein-1 activation in High Fat Diet-Induced Obesity at Thermoneutrality**

Kyle Biehl  
Baskaran Thyagarajan, PhD  
School of Pharmacy  
University of Wyoming  
Oral Presentation

*INBRE*

*Tinnath, CO*

Obesity results from an imbalance of energy expenditure and intake and can be combatted by increasing energy expenditure. Activating the protein TRPV1 (Transient Receptor Protein Vanilloid subfamily 1) has been shown to do this. Capsaicin is a known agonist to the protein TRPV1, which when active, upregulates Uncoupling Protein-1 among other thermogenic proteins; this leads to increased energy expenditure. Mice used for research are typically housed at ambient temperature (22oC); where mice experience mild cold stress. This study aimed to test if, at a thermoneutral temperature, capsaicin can activate UCP1 to decrease weight gain. In the absence of cold stress, housed at a thermoneutral temperature (30oC), mice have decreased energy expenditure and were expected to gain more weight in comparison to mice which housed at ambient temperature. Mice were housed within their designated environment, and at six weeks of age were segregated into three groups, a normal diet, a high-fat diet, and a high-fat diet with capsaicin. The mice used were either of the wild type variety or lacking the UCP1 gene; the wild type mice functioned as the control group, and the UCP1 knockout mice were the experimental group. Throughout the feeding study body weight, respiratory exchange ratio, water, and caloric intake were measured; thermogenic protein levels were determined after completion of the feeding study. It was concluded that capsaicin could decrease weight gain in mice housed at a thermoneutral temperature in both UCP1<sup>-/-</sup> and wild type mice with no significant difference from mice housed in ambient temperature.

## **Girl's Night**

Amanda Biggs and William Missouri Downs  
Department of Communication and Journalism, Department of Theatre and Dance  
University of Wyoming  
Oral Presentation

*Honors Program, Department of Creative Writing*

*St. Louis, MO*

In this presentation, I will discuss my full-length feature script entitled “Girls’ Night” that was written over the course of the past ten months. A comedy that highlights a part of the girl world uncharted by men, “Girls’ Night” focuses on the unique bond held by women and what happens when a man is let into this tightly knit circle. Comparisons will be drawn from modern male-female relationships seen in television and movies as well as personal experiences that led to the fruition of this particular project. Brief scenes will be read by actors and then discussed and elaborated on by myself.

## **Combining Long-Term Monitoring and Lab Trials to Understand Effects of Road Salt Application on Sheridan County Streams**

Walker Billings with Dr. Scott Newbold  
Department of Life Sciences, Biology Program  
Sheridan College  
Poster Presentation

*Department of Life Sciences*

*Sheridan, WY*

Chloride based solutions have been used to melt ice on roads since 1938. In 2010, the U.S. used an estimated 10-20 million tons of road de-icer. Data has shown that chloride levels in freshwater streams exceeding 1000 mg/L can adversely affect stream life, and that increases in application of salts, especially to impermeable city landscapes, can increase salinity levels of nearby streams. Multiple organizations have been conducting long-term monitoring of the Goose Creek watershed in Sheridan County, however, there have been no formal analyses of the trends in salinity or studies evaluating potential environmental impacts. In this study, I will determine trends in stream salinity using existing data from the Sheridan County Conservation District (2001-2018), collect new data (2019) specifically following snowmelt events to capture salt runoff, and test how two local species react to various salinity levels. New salinity measurements will be collected at five sites at two times, once after a significant snowmelt event, and again after a warmer period with no precipitation. To evaluate road salt effects on aquatic ecosystems, I will apply historic, current, and possible future salinity values to dominant, local, streamside vegetation such as smooth brome (*Bromus inermis*) and a common aquatic invertebrate such as *Daphnia* sp. in a laboratory setting. I hypothesize that increased salinity levels will result in decreased growth of smooth brome and lower survival rates for daphnia. This study will contribute to our understanding of the impacts of road salt application on the aquatic and riparian ecosystems in Sheridan County.

## **Gesture Controlled Robotic Hand**

Holden Bindl, Clint Walker, Dr. Suresh  
Electrical and Computer Engineering  
University of Wyoming  
Oral and Poster Presentation

*Electrical and Computer Engineering*

*Laramie, WY*

The current limits in technology and methodology makes the transition after an amputation very difficult for most people. This is mostly due to the negative, non-human aspects of a prosthetic. To add some research and a foundation to this issue, this project will be based on a design to create a robotic arm that will mimic the hand gestures of a subject. The design goal is to create a product that can take sensory input from the upper parts of a person's forearm and translate them onto a mechanism that will recreate the desired movements. This will be done using the Myo Armband that monitors electrical muscle signals produced when the person moves their hand. The main focus of the project will be the completion and implementation of the neural network. The neural network will be the main software component that will take the inputs from the person's arm and translate them to the robotic hand. This will be programmed in Python and later implemented onto a Raspberry Pi 3. Our neural network will be trained using an open source data set collected from Kaggle.com. The data set includes raw Electromyography (EMG) data of four unique gestures collected using the Myo Armband. This design is not meant to create a prosthetic, but to lay the groundwork towards creating a similar system that works towards prosthetics and the enhancement of a smoother transition for an amputee.

## **Extreme Variations in Personality Related to Sexual Assault Perpetration**

Kendal Binion, Matt Gray, Alexandra Quinn

Psychology

University of Wyoming

Poster

*McNair, Honors*

*Wheatland, WY*

Approximately 20% of young, American women and five to ten percent of young, American men have experienced some form of sexual assault (Hoertel, Strat, Schuster, & Limosin, 2012). Past research suggests that extreme variation in personality influences the development of several psychological deviances, including sexual aggression. Researchers hypothesize that individuals who are significantly above average in extraversion and significantly below average in agreeableness will be more likely to engage in the perpetration of sexual coercion and sexual assault. Data will be collected through Amazon's survey tool, M-Turk. Within M-Turk, males 18 years and older from the general population will be invited to participate. Demographic questions will provide data on age, ethnicity, socioeconomic standing, education and sexual orientation. An abbreviated version of the Big Five Personality Trait Questionnaire will be administered to test personality variations. In gathering data on past perpetration, the perpetrator version of the Sexual Experiences Survey will also be given. The present study intends to provide information that may identify individuals with a higher likelihood of engaging in sexual coercion and sexual assault; this may allow for more effective sexual assault preventive methods and training to be put in place.

## **Wire Rope Assembly Tools**

John Birkholz, Brittany Brasfield, Corissa Guynes, Colter Larson, with Professor Lawrence

Willey

University of Wyoming

Oral Presentation

*Engineering Program*

*Laramie, WY*

All-Lifts is a company that was founded in 1966 in Albany, NY; they make a variety of wire rope slings and hand tools. This project will be focusing on increasing the efficiency of manufacturing wire rope slings. The current development of wire rope slings could be considered outdated, as the process is labor intensive, dangerous, dirty, and wastes material. The objective of this project is to develop a series of hand-tools to minimize the labor, make the process safer and cleaner, and eliminate the wasted material. This unused material is one-foot of wire rope per wire rope sling, as it used for leverage and then cut off at the end of the process. As a result, these hand-tools will save All-Lifts approximately \$3000 to \$4000 a year in material alone, while also removing unnecessary steps in the process. The design concept is to make two hand tools, one for each spliced end of the cable.

## **Production of Sodium Carbonate and Sodium Bicarbonate from Trona Mine Water**

Nick Blume, Delaney Dent, Zach Legerski, Savannah Richter, and Ben Staldine, with Dr. Bell  
Chemical Engineering  
University of Wyoming  
Oral Presentation

*College of Engineering and Applied Science*

*Laramie, WY*

Believe it or not, the largest deposit of trona in the world is found in southwest Wyoming at the Green River Basin. Trona is a mineral that has been mined and refined into sodium carbonate and sodium bicarbonate since the 1950's. Sodium carbonate, also known as soda ash, is a main component in glass production. Sodium bicarbonate, known as baking soda, is primarily used in the food industry. Trona is conventionally mined underground using mechanical mining methods. However, mechanical mining has limited recovery. To increase recovery of trona, a secondary method of extraction called solution mining is being used. Solution mining is the flooding of abandoned mines with water which dissolves the remaining trona. This solution is pumped back to the surface and refined into the desired products. The goal of this project is to integrate a solution feedstock into Ciner, an existing trona processing facility in the Green River Basin. The scope of this project is to produce 500,000 tons of product. Implementing this change will decrease costs compared to mechanically mining, resulting in a higher profit margin for Ciner. Also, the reuse of existing Monohydrate processing equipment will greatly reduce capital costs for this project. Currently, the Ciner unit only processes trona into sodium carbonate. Another goal of this project was to determine if the conversion of 2% of the product to sodium bicarbonate would be beneficial to the facility. Preliminary results have indicated that this addition is not economically feasible at the given design specifications.

## **Delaware Basin Frac Optimization JACK Oil Senior Design Project**

Jace Bohmer, Diego Carpintero, Tyler Kinnon (team lead), Austin King  
University of Wyoming

With the development of horizontal drilling and hydraulic fracturing in the last decade, many reservoirs and formations have started to look a lot more economically friendly. Jack Oil has been tasked with analyzing completion data for one of these highly active areas in southeast New Mexico. In the heart of the Delaware basin, the Wolfcamp is an organic rich shale formation that produces high quality oil and gas. In partnership with Matador Resources, an active producer in the area, Jack Oil is analyzing over 100 oil producing wells completed within the last 5 years in a 9-section area by looking at several key frac parameters. Such as treatment type, pounds of proppant per lateral foot, pounds of fluid per lateral foot, pounds of proppant per gallon of fluid, etc. Jack Oil is determined to provide our client with an optimized completion program for this specific area to maximize production while also lowering completion costs.

## **Dinwoody Ghost Forest: Alpine Paleoecology in the Wind River Mountains**

Rita Bove

Central Wyoming College

CWC archaeology students participating in the Interdisciplinary Climate Change Expedition (ICCE) have mapped 70 logs and stumps at nearly 11,000 feet on Arrow Mountain immediately adjacent to the Dinwoody Bison Jump. Other researchers have found evidence of similar ghost forests on Union Pass and at High Rise Village. The sampled Arrow Mountain specimens C14 date between 1,100 and 3,000 years BP and indicate that prehistoric tree line was approximately 500 feet higher than today. This ancient forest probably provided logs that bolstered the Dinwoody bison drive lines and perhaps to build a corral beneath the jump off. At least one pine branch dated 2,910BP was used as a flagpole in the driveline. These relict trees show little sign of stress and provide insight into paleoclimate that can help us understand more about climate change and the prehistoric environment in which Archaic hunters and gatherers lived and thrived in the high alpine.

## **ASEE RMS Conference 2019**

### **Mech. Eng. Senior Design**

Jackson Bower, Vinchinzo Castle, Ben Schreckengost, Jorden Schulte

Granite Construction proposed a project to improve the offloading system at their regional asphalt plants. The current system for asphalt oil offloading at most of the plants consists of manual operated inlet valves and rudimentary level indication for the storage tanks. There is a large amount of risk involved with filling a storage tank with hot oil by manual operation. Overfilling the tanks could result in expensive inventory loss, property damage, and operator injury. Granite Construction has requested our team to design and implement a system that automatically controls the flow and level of liquid asphalt within the storage vessels. The primary scope of this project consists of implementing horizontal tank level measurement devices and a valve actuator system to fit the needs of the project administrator. Radar level indication will be used to monitor liquid asphalt volumes in each tank. The radar data will be continually relayed to the control room by integrating into the existing SCADA system. The system will determine the appropriate actions to take, and actuated valves will be operated automatically. The system will be designed to react accordingly to emergency situations, actuator failures, and operator overrides. The economic viability of the project will be considered to justify construction of the system. Granite Construction plans to install the completed system in many of their current asphalt plants. A rate of five systems per year is desired by the project administrator. Project cost analysis and internal rate of return will decide actual rate of future system implementation.

## **Identification of Competitive Relationships between Naturally Occurring and Inoculated Microorganisms from Chill Switch Wines**

Tucker Bower with Dr. Rachel Watson and Dr. Gerard Andrews Microbiology

University of Wyoming Oral and Poster Presentation

Historically alcoholic beverages were simply stored in an open container and fermented over time by naturally occurring yeasts from the environment. In modern, industrial winemaking, pressure to produce a consistent product has turned winemakers to rely on addition of harsh chemicals and highly alcohol tolerant strains of *Saccharomyces cerevisiae* to control the microbiome of the wine must. Much of the microbiological diversity within the fermenting wine is lost in this process, and those who drink the wine are not exposed to potentially healthy probiotic organisms found in traditional wines. Thus, a wine microbiome study was designed to identify microbes within a naturally fermented wine and to test the nature of the relationships between those microbes *in vitro*. The goal of this project was to isolate and identify the microorganisms present in fermenting wine must sampled from Chill Switch Winery in Cedaredge, Colorado. In previous work we performed, bacterial and yeast from wine have already been isolated and analyzed by gram stain and morphological appearance. MALDI-ToF mass spectrometry will be used to identify the isolated bacteria and yeast. Secondly, a competition assay will be performed via broth and agar culture methods in an attempt to quantify the relationships between individual species isolated from the wine.

## **The Ants Go Marching One-by-One: Metabarcoding the Hymenoptera Microbiome of the Big Horn Basin**

Camille L. Brandt, Sidney D. Brooks, Lara M. Chanthongthip, Fantasia Critchfield, Emilie D. Edwards, Gareth G. Flowers, Jacklyn A. Green, Drew Groll, Pascal Hagenimana, Tawna R. Herrera, Abigail L. Hogan, Wyatt J. Horrocks, Brianna N. Kilpatrick, Chaz P. Krone, Richard A. Mangali, Carissa A. Schmidt, Laura Shoopman, and Tabitha N. Tyrrell; and Allan Childs, Elise Kimble, and Eric C. Atkinson (Faculty Mentors)

*Northwest College, Biology Department*

*Poster*

*INBRE*

*West Plains, MO.*

*Cody, Cowley, Lovell, Powell, WY.*

Ants comprise a ubiquitous family (Formicidae) of the Hymenoptera contributing hugely to the functioning of ecosystems. To investigate the microbiome of ants and wasps (Vespidae) inhabiting the Big Horn Basin, we aseptically collected over 50 samples using point-of-collection software (Anecdata.org) to document spatial distribution from areas east and south of Lovell, WY to Belfry, MT. Bioinformatics theory and application became the central theme of Biology 2465 "Research Problems in Biology", introducing undergraduates to genomic analyses. We extracted DNA from whole-body homogenates, amplified 16S ribosomal DNA (V4 region) following Earth Microbiome Project protocols and sequenced on Illumina platform. Metabarcoding data were characterized via the QIIME2 pipeline to compare patterns of microbial diversity across space and ant/wasp taxa.

**An Examination of Red Fox (*Vulpes vulpes*) Pelage Color and its Link to Immune System Function Based on the Presence of Bacterial Taxa**

Camille L. Brandt and Eric C. Atkinson  
*Department of Biology, Northwest College*  
Poster

*INBRE*

*Lovell, WY*

The phenomena of melanism (caused in most organisms by a mutation in the Melanocortin 1 receptor (MC1R) gene) has been linked in insects and feral pigeons (*Columba livia*) to an overall stronger immune response than their non-melanistic counterparts. Cross foxes are a partially melanistic color variant of red foxes (*Vulpes vulpes*) and have a typical pelage (coat) color of overall red except for a black/silver streak on the neck and back. This pelage color combination is thought to result from interactions between agouti, a protein associated with a grayish bridle color in mammals, and the MC1R gene that can result in either black or red hair color. The goal of this project is to test if the partial melanism present in cross foxes has any effect their immune system response compared to the non-melanistic red fox color type based off tissue associated microbiome diversity. The assumption is that red color type individuals could support a greater amount/diversity of taxa and/or pathogenic taxa. DNA samples of both red and cross fox color types were obtained ( $n=25$ ) with the purpose to extract, amplify, sequence and analyze for any statistically significant differences in bacterial taxa presence between red and cross color types.

**Nitrate uptake potential relative to land use in semiarid environments**

Phillips Brandon, Amanda Johnson, and Christopher Wenzel  
Department of Science and Mathematics  
Eastern Wyoming College

*INBRE*

The majority of terrestrial plants use nitrate as their main source of nitrogen. Nitrate is a known groundwater contaminant which can adversely affect human health. However, it also plays an important role in vital physiological processes required for plant growth and development. Nitrate uptake potential can be used as an indicator of both plant health and environmental quality. A synopsis of two of the genes involved in nitrate uptake (CHL1 and NRT1) along with their relative presence in various land uses (i.e. grazed-grassland, cropland, urban, wetland, sub-irrigated) is presented. An enhanced understanding of the role these genes play in nitrate uptake relative to various land uses will improve our understanding of nitrogen use efficiency in plants and their potential to prevent nitrates from contaminating groundwater.

## **Malaria: A Scientific Review**

Lachlan Brennan with Dr. Pamela Langer  
Department of Molecular Biology  
University of Wyoming  
Oral Presentation

*Honors Program*

*Sheridan, WY*

Malaria is by far the world's most common cause of parasitic morbidity and mortality. In the year 2017, approximately 219 million global cases of malaria occurred along with 435,000 deaths caused by infection. Malaria is a parasitic disease of red blood cells caused by microorganisms of the Plasmodium species usually contracted and spread by the female Anopheles mosquito: typical symptoms include headache, vomiting, and fever with more serious manifestations resulting in jaundice, seizures, coma and even death. While malarial infection is usually non-fatal, some types are implicated in chronic recurrence, vascular occlusion, and diminished oxygen transport (hypoxia). The type and severity of malarial infection is predicated upon the species of parasite, with each of four types possessing different characteristics and distinct impacts on pathogenesis and mortality. Treatment primarily involves pharmaceuticals targeting various stages of the Plasmodium life cycle by either killing the parasite or preventing its replication. Prevention involves protection from mosquitoes with netting and the recent completion of clinical trials on the first anti-malarial vaccine to be approved by the WHO in 2015. In addition, high-risk populations in historically tropical areas may possess genetic alterations that facilitate resistance to the malarial disease process of which the biochemical consequences of Sickle Cell Disease as well as a condition known as Glucose 6-Phosphate Dehydrogenase Deficiency will be discussed. This review concerns the specific challenges associated with current malarial treatment as well as current efforts to produce a lasting viable alternative to current disease management.

## **Probing the Structural Mechanism of BAK Activation in Mitochondrial Apoptosis**

Reba Brenner  
University of Wyoming

*Honors*

Mitochondrial apoptosis is one of the most common forms of apoptosis implicated in health and diseases like cancer and autoimmune diseases. The B-cell lymphoma 2 (BCL-2) protein family mediate mitochondrial apoptosis by regulating mitochondrial outer membrane permeabilization (MOMP). BCL-2 antagonist killer (BAK) is one of the effectors of MOMP. BAK binds the direct activator Bid to undergo poorly understood, allosteric, conformational changes leading to MOMP. BAK is thought to oligomerize during MOMP at two interfaces mediated by  $\alpha 2$ - $\alpha 5$  region and  $\alpha 6$  helix. The lack of correlation between putative dimer structures and membrane permeabilization results raises questions to the role of the proposed oligomerization. We tested the putative  $\alpha 2$ - $\alpha 5$  dimer by mutagenesis, biophysically and functionally. Based on our analysis WT BAK forms inactive dimers in the presence of detergent. Mutations in the BCL-2 homology region 3 (BH3) ( $\alpha 2$  helix) and  $\alpha 3$  helix which should impact the proposed  $\alpha 2$ - $\alpha 5$  generated active monomers. Our study challenges the role of the putative dimer in membrane permeabilization, MOMP and apoptosis initiation.

**Does distance make the heart grow fonder?  
A look at the impact of long distances on premarital, collegiate relationships.**

Jamie Bridenstine with Beau Bingham  
Department of Communication and Journalism  
Oral Presentation

*Cheyenne, WY*

As students make their way to college, they have many things to worry about. Some will worry about their new classes, the difficulty of those classes, or might be thinking about graduation already. Others might begin to wonder of the various parties they will attend, the sororities or fraternities they will pledge, or joining any student clubs on campus. Students that are in relationships may wonder if their long-distance relationships will survive throughout college. The purpose of this study was to investigate the influence of long distances on the communication of college students in romantic relationships. 30 (N=30) students completed the survey. The happiness of one party in the relationship was found to be positively correlated with the hours spent communicating between the two.

**Developing Chimeric Spider Silk Proteins as Biomaterials for Use in Medical Applications**

Morgan Brooks with Dr. Florence Teulé-Finley  
University of Wyoming at Casper  
Poster Presentation

*Wyoming INBRE*

*Casper, WY*

The mechanical versatility of spider-silks makes them superior materials for use as a biomaterial. This research project focused on producing chimeric spider-silk proteins to be used in the development of biomaterials. Specific recombinant histidine-tagged spider silk proteins were generated by previously characterized recombinant bacterial silk clones. The recombinant silk proteins were then extracted and purified by immobilized metal affinity chromatography (IMAC). The purified spider silk proteins were dialyzed against ammonium bicarbonate. In the future, these silk proteins will be lyophilized, and their use will be explored in the production of biomaterials.

**Autonomous Airplane Deicing**  
Nathan Brown, Heath Richards, and Caleb  
Wilkins Department of Mechanical Engineering  
The University of  
Wyoming Oral and Poster

*JB Aerotecch*

*Laramie, WY*

A 2014 report for Denver International Airport (DIA) found that reducing deicing time by just three minutes per plane saved over 6 million dollars per year in jet fuel alone ["Snow Removal," 2018]. Today's aircraft deicing systems are modified versions of designs from the 1960s, which incorporated deicing trucks equipped with a man-bucket operated spray boom. An automated deicing system should lead to significant savings by reducing labor requirements and increasing aircraft deicing efficiency. Therefore, the primary objective of this project is to create an autonomous deicing system that is scalable to all variants of the Boeing 737. The resulting design consists of five deicing towers with telescopic spray booms like those currently used on deicing trucks - but without the man-bucket. The towers move along a series of tracks that form an outline around the plane being deiced. The tracks are actuated via hydraulics that rotate away from a stationary rail positioned along the leading edge of the aircraft wing. Aircraft deicing fluid is delivered via computer-controlled spray nozzles that are guided by position feedback sensors - as well as knowledge of the geometry for the aircraft being deiced. When the rails are fully retracted, the towers are outside of the plane's wing span, so that aircraft can enter or exit the deicing area without interference. SolidWorks was used to complete motion-time studies for the design. Additionally; a functionality document, parts list, and cost estimates were produced to form the basis of continued project development by the sponsor.

**Preliminary Transcriptome Analysis of Adult  
*Culex tarsalis* Mosquitoes Collected in Fremont County, Wyoming**

Micah Conner, Russell Brubaker, Shaylee Ketelhutt, Jessilyn Monahan, Serdar Gayybov, Caleb  
Ceclre and Aaron Bender

Department of Math and Science Central Wyoming College

Poster and Oral Presentation

*INBRE*

*Riverton, Cheyenne, Lander, WY and Mary, Turkmenistan*

Fremont County is a hotspot for West Nile virus (WNV) infection in Wyoming. It is known that the mosquito *Culex tarsalis* (*C. tarsalis*) serves as the primary insect vector for WNV in western states such as Wyoming. Although a great deal is known about the transmission, replication and genetics of WNV, very little is known about the genome structure and gene expression profile of the *C. tarsalis* host. Our research team captured mixed populations of wild mosquitos in Fremont County. These were sorted and adult *C. tarsalis* were positively identified. Total RNA from this pool was isolated, column-purified and quantified. Two parallel samples of high quality total RNA were submitted for Illumina next-generation RNA sequencing. Upon completion of the sequencing our dataset consists of nearly 350 million paired-end reads. The average data yield for the 2 samples is approximately 50,000 megabases with a Q score of  $\geq 30$  for over 91% of called bases and has a mean quality score of nearly 38. In collaboration with the University of Wyoming INBRE bioinformatics core, our research team intends to reference the genome sequence of *Culex quinquefasciatus* to build a preliminary physical map of the *C. tarsalis* genome and identify interesting polymorphisms between the two species. Finally, by utilizing a combination of our RNAseq data set and our new qRT-PCR thermocycler, we will attempt to identify whether the mosquitos were infected with WNV or potentially other members of the flaviviridae.

## **Small Wildlife Tracking Drone**

Designed by: Robert Bryant, Alec Mesa, Rick Pantuso, Caleb McArthur

Advisor: Zachariah Hampton Bell

Oral Presentation

*Engineering Program*

*Laramie, WY*

The Wildlife Tracking Drone was a project proposed by the Zoology Department of the University of Wyoming in order to minimize the time Graduate Students take in tracking and recording the location of small collared wildlife tagged for study. Generally, students use a handheld directional antenna to track wildlife using VHF radio collars attached to the animals. Then walk in the general direction of the signal until the animal is spotted. Due to the small stature of the animals, the large range that they inhabit and the type of the terrain, it can be difficult to find them during the allotted time period. Our solution is to use a hexacopter drone with a fixed phased array to locate the animals and mark their GPS location. This solution will minimize health risk and time for Graduate Student researchers in the field as well as increase the number of animals located during the same period of time relative to hiking.

## **First Grade Lesson Plan Development and Implementation**

Brittney Buckler and Kristi Von Krosigk

Education

University of Wyoming

Oral Presentation

*Honors Program*

*Sheridan, WY*

Curriculum development is an in-depth process that considers many facets such as materials, student interest, standards, content, and the development of higher order thinking skills. Sequential development is important, as information should build on each other. This technique is beneficial for presenting materials in a clear, concise way and allows for ample practice of the skills which would help students put the information into their long-term memory (Arends, 2015). According to the child psychologist Vygotsky, content should also be presented in a scaffolded manner that creates a Zone of Proximal Development (ZPD) so students are able to learn and reach their full potential in the curriculum. I created and taught a series of four lessons that use scaffolding to teach first grade students place value. The project involves lesson development, teaching, and assessment. Each section is accompanied by rationale and reflection. Only through assessment and reflection will the teacher know if the lessons and methods of teaching were effective. Overall, the students understood the basic concepts that were asked of them, although the wording on some of the assessment questions tricked a couple of the students. In addition, some changes could have been made to the lesson plans themselves to better fit the timeframe and the students' needs.

**The Relationship Between Local Microbiome and Plant Communities - a High Elevation Study on the Slopes of Mt Kilimanjaro in Tanzania, East Africa**

Emilia Bulfone, Tobias Osborne, and Gabriel Spoonhunter

Faculty mentor: Jacki Klancher

Alpine Science Institute

Central Wyoming College

Poster Presentation

*NOLS, INBRE*

*Lander, WY*

In January 2019 microbial communities on Mt. Kilimanjaro were sampled across four differing climatic and vegetation zones. The first objective was to establish a baseline inventory of diversity and density of species present. The second objective was to assess correlations between composition of soil microorganisms and plant growth at different elevations. A qualitative observation at different elevations indicated reduced plant size and reduced density of *Senecio kilimanjari* and *Lobelia deckenii* across increasing elevations. Five microbial communities - each at different elevations and representative of different climatic life zones were sampled during this study. Height and leaf length of *Senecio* and *Lobelia* native plant species were performed on plants associated with these same sites. In the upcoming months, samples will be outsourced for DNA sequencing. After sequencing, it is anticipated that results will reveal correlations between the density and diversity of associated microbial communities and association with various plant communities. That is, despite changes in precipitation and elevation, the relationship between the plants themselves and local soil characteristics will remain constant. In contrast, it is predicted that the density and diversity of microbial communities above 17, 000 feet and distant from any plant communities will exhibit significantly different values in density and diversity.

**A Social Work Understanding of American Indian Education in Wyoming**

Remi Bullock with Dr. Kirsten Havig

Social Work

University of Wyoming

Oral Presentation

*Honors, Social Work Department, Health Sciences*

*Houston, TX*

The history of education about and for American Indians in the United States is rooted in cultural elitism. Beginning in the 19<sup>th</sup> century and continuing into the 20<sup>th</sup> century, American Indian children were forcibly taken from their families and placed in boarding schools; these boarding schools were run by the U.S. government and evidenced the U.S.'s goal to rid the country of American Indian culture. Racism plagued the U.S. education system for decades, and despite contemporary legislation to move away from this oppression of American Indian perspective in education, the social injustice in many ways persists. According to the ethical code enforced for the social work profession, social workers must be the frontrunners to promoting social justice. Because of this ethical obligation, a social work lens must be utilized to understand the current level of secured social justice regarding American Indian perspective in education across Wyoming. The goal of this project was to analyze the social justice of the American Indian education program provided by Wyoming Engrossed Bill 119 that was passed in 2017. Furthermore, a social work perspective was used in this research to analyze the current level of secured social justice to American Indian perspective in Wyoming education. This social work perspective additionally provides a pathway for increasing the security of social justice to American Indian perspective for the future of education in Wyoming.

## **Why Can't We Say "No"?**

Delta Burchi and Travis Brown, PhD  
Department of Pharmaceutical Sciences  
University of Wyoming  
Oral Presentation

*Honors, Wyoming Research Scholars Program*

*Laramie, WY*

The opioid epidemic is one of the largest problems America has ever faced. Opioid abuse has a significant fiscal and social burden, even though prescription rates have been steadily declining since 2012 (CDC, 2018). With yearly overdoses and deaths on the rise and opioids remaining a necessity in modern medicine, it is critical to have a basic understanding of opioids in order to begin successfully treating/preventing addiction while still effectively managing pain. In a similar fashion, humans as a species are struggling with rising rates of obesity as palatable foods become more accessible and technology continues to simplify once strenuous tasks. With obesity annually costing the United States over one-hundred billion dollars and affecting over one-third of U.S. adults (and rising), researchers and scientists all over the world are scrambling to find a solution to the dilemma. Notably, people struggle to wean themselves off drugs that adversely affect their minds and bodies in a way that is uncannily similar to how difficult it is for people to put down the cookies and spend their money on fresh vegetables. I will outline the mechanisms (currently understood) by which drugs and palatable foods affect the brain and body, their similarities and differences as well as investigate future prevention and treatment options for both maladies. As different as they may seem, studying obesity and drug addiction together may just help us resolve why humans struggle so immensely to just say "no".

## **Distribution and Frequency of Antibiotic Resistance in the Environmental Resistome**

Hannah Burrough & Caitlyn Edwards with Dr. John Chase  
Microbiology  
Casper College  
Poster Presentation

*INBRE*

*Casper, WY*

The emergence and spread of antimicrobial resistant genes pose a threat to healthcare systems worldwide. Although this issue is significant, little research has assessed the environmental factors contributing to the rise of antibiotic resistance. Environmental microbiota represents one of the most diverse reservoirs of antimicrobial resistance, known as the resistome. The resistome includes not only the genes that confer resistance to clinical pathogens, but also to the nonpathogenic species that dominate the environment. While the resistome is ancient, modern day selective pressures are undoubtedly shaping its current form, degree of mobility, and allele frequency. The primary focus of this project is on eukaryote, prokaryote, and viral populations in the environmental resistome. Over 100 water samples have been taken from aqueous systems, including freshwater, mineral hot springs, and wastewater, throughout Wyoming. Metagenomic DNA is being isolated for beta-lactamase genes to map genes found throughout Wyoming's water systems. The changes between the microbiome and resistome of these water sources are being analyzed to gain a better understanding of where beta-lactamase genes occur in the environment. The current goal of this project is to finish the ongoing analysis of beta-lactamase genes found in the samples through the creation of metagenomic DNA libraries; specifically focusing on SHV-1 and OXA-1 beta-lactamase genes due to their recent increase in prevalence. Following library creation, DNA will be sequenced followed by bioinformatics analysis. The long-term future goal is to present a more accurate map of the beta-lactamase genes distribution and frequency throughout Wyoming.

## **Bioproduction/Optimization of Magnetic Nanoparticles from the Bacterium**

### ***Magnetospirillum magneticum* AMB-1**

Jacy Busboom with Dr. Karen Wawrousek

Chemical Engineering

University of Wyoming

Poster Presentation

*INBRE*

*Douglas, WY*

The magnetotactic bacterium *Magnetospirillum magneticum* AMB-1 naturally produces magnetic nanoparticles through the uptake of iron and subsequent synthesis of magnetite ( $\text{Fe}_3\text{O}_4$ ) in microaerobic conditions. Desirable properties of these nanoparticles include biocompatibility and a magnetic dipole at room temperature, ideal for biomedical treatments such as hyperthermia cancer treatments, immunoassays, drug delivery, and improved magnetic resonance imaging. Other metals can be added to growth media for incorporation into magnetic nanoparticles, forming crystals that are not pure magnetite. This process, called doping, can alter nanoparticle size and magnetic properties. In this work, carbon and iron sources in growth media were optimized for bacterial growth and magnetic nanoparticle formation, and magnetite nanoparticles were doped with rare earth metals. We hypothesized that rare earth metals with smaller atomic radii would incorporate into magnetite more than those with larger atomic radii, as the smaller metals have a radius closer to that of iron. Using various methods, such as energy dispersive x-ray (EDX) spectroscopy, transmission electron microscopy (TEM), and Curie Point determination, we verified the presence of dopants, measured their size, and measured their magnetic properties. We concluded that our hypothesis was wrong, as no dopant incorporated into the magnetite with any of the metals.

## **Historic Potentials: The Question of Inevitability and the Second World War**

Stuart Cameron with Dr. Adam Blackler

History

University of Wyoming

Oral Presentation

*Honors*

*Laramie, WY*

This paper will discuss the question of whether the Second World War and the Holocaust were inevitable events in European history or were rather possible outcomes of historic potentials which arose before these events. These historic potentials included the aftermath of the First World War, Treaty of Versailles, the concept of self-determination, antisemitism, economic strife, nationalism, and population politics. After the First World War Europe was in turmoil due to the impact of the losses (casualties and resources) caused by the war. The Treaty of Versailles produced ideas of hypocrisy through both the promise and denial of national rights and pre-Armistice agreements. Similarly, potential of self-determination, “guaranteed” to nations, were denied to other nations thus creating a sense of animosity. Antisemitism created the potential for “willing executioners” of the Holocaust throughout Europe. Economic strife became a dangerous potential, since the global crash during the Great Depression, along with other economic crises in Europe allowed for the possibility of fascist or other totalitarian based groups to rise in Europe since they provided solutions for these crises. Nationalism became a dangerous potential since it allowed for states to define who did or did not belong in the state and “justifying” the persecution of “others.” Lastly, population politics created the possibility for authoritarian leaders to gain power by appealing to large populations of people. Thus, the Second World War and the Holocaust were not inevitable events but were rather outcomes of various dangerous potentials which arose in Europe after the First World War.

## **Second Scottish Referendum**

Victoria Campbell

Individual

University of Wyoming

### *Business, Honors*

Scotland has long had a quarrelsome relationship with the United Kingdom. This has ultimately led to the destruction of the traditional Scottish way of life, when England and Scotland formed the United Kingdom in 1707. Since then, Scotland has effectively been under the rule of a nation that has different values and different goals. This was most recently brought to sharp focus by the British referendum to leave the European Union. In 2016, a majority of voters in Scotland chose to stay with the EU, though England carried the vote to leave. Therefore, despite voting to remain in the United Kingdom in their own Referendum in 2014, many Scottish citizens are increasingly displeased with the balance of power. Because of this, there has been an increasing wave of support for a second referendum for Scottish Independence from the UK. In 2014 it was impractical for Scotland to split from the UK, as they would have had to deal with not only establishing their own government more strongly, but also with applying to join the EU. With Brexit, that concern is less relevant. Additionally, because Scotland already has a government and bank, it is not inconceivable that they could become independent. By looking into the process of the Republic of Ireland leaving the United Kingdom, and of applying to join the EU, as well as the other challenges of establishing a new country, this paper will consider whether or not it is economically feasible for Scotland to become an independent country.

## **AirLoom Energy 6m Wing Design**

Luke Case, Alex Finnegan, Eric Magana, Minheok Seo, Dr. Kevin Kilty Prof. Lawrence Willey

Mechanical Engineering

University of Wyoming

Oral Presentation

*Laramie, WY*

Wind power is growing in popularity around the world, but its cost-benefit is too high and that is where AirLoom Energy comes into play. Robert Lumley, a self-taught engineer is the inventor of the AirLoom and is the founder of AirLoom Energy. The cost reduction can be attributed to an approximate savings of 15x and would be 23x less mass than a traditional horizontal axis wind turbine (HAWT). The proposed technology captures energy through translational rather than rotational motion in the tips of the airfoils as they run along a rail tethered by bridles. AirLoom Energy currently has a track with a 2-meter wing, but intends to scale it up to a 6-meter center supported wing using a symmetric, NACA 0018 airfoil shape. The proposed rail speed for the airfoil will be near 40 m/s and thus flaps will be implemented to both slow the airfoil down around turn and stabilize it after the turn. For maximum control, the flaps will be one meter in length on each end of the wing and will be 25% of cord length. Using the flow simulation feature in Solidworks and the Finite Element Analysis (FEA) tool allowed for numerous parameters to be evaluated: air flow over the wing, movement of flaps, number of wings that can be placed along the rail system, stress, strain, and strength of the design to determine if the scaling of the wing up to a 6-meter design is practicable and can withstand the desired conditions.

## **Association Between Alzheimer's Disease and Depression**

Haley Cates with Dr. Margaret Flanigan

Physiology

University of Wyoming

Oral Presentation

*Honors*

*Cheyenne, WY*

An estimated 5.4 million people have Alzheimer's Disease (AD) in the nation, making it the most common neurodegenerative disease in the US. The mortality rate for AD has steadily increased in the last 30 years. Clinical symptoms begin to occur at the age of 65, with recent declarative memory decline as the leading symptom; the further the disease progresses, the greater the depth and type of memory loss that occurs. Along with this, neuropsychiatric symptoms such as anxiety, irritability, depression, and apathy arise. In fact, co-incidence of dementia and depression is common, with 50 percent of patients experiencing an episode of depression during the course of their dementia. Symptoms of depression can include dysphoric mood, losing interest in enjoyable activities, and having difficulties eating and sleeping. Such symptoms can also be symptoms of dementia, making it hard to clinically distinguish between the two. And although depression is a recognized comorbid condition with AD, there have now studies investigating whether depression may also be a risk factor for the development of AD. Subsequently, scientists are now researching whether early intervention of depression has an effect on the risk of developing dementia. Overall, it is important to emphasize that the link between Alzheimer's Disease and depression is still not well understood and further research in multiple arenas is needed.

## **The Effects of Intermittent Fasting on Blood Insulin Levels and Insulin Sensitivity: A Literature Review**

Shantel Centner with Dr. Amy Navratil

Physiology

University of Wyoming

Oral Presentation

*Physiology, Honors*

*Gillette, WY*

Obesity has become a major concern for healthcare professionals and the general public in the United States over the past few decades. Other nations have recently begun to experience an increase in obesity rates as well. Though practitioners and organizations have presented various treatments for those experiencing this disease, including medications, restriction diets, calorie counting, and exercise regimens, people still become morbidly overweight. Dr. Jason Fung took another approach to the obesity epidemic and came to the conclusion that the disease is a result of insulin resistance. He proposes intermittent fasting as a treatment option for overweight and obese individuals. This literature review sought to test the present theory that intermittent fasting reduces insulin resistance. Though findings were mixed, the general consensus of the articles reviewed was that intermittent fasting does positively affect insulin by reducing fasting insulin levels and increasing insulin sensitivity. More research is needed to confirm this conclusion, as well as to investigate other aspects of diet and fasting such as gender, time of day to eat, types of foods eaten, and length of fasting periods.

## **Solaris VR**

Jacob Centner with James Ward  
Computer Science  
University of Wyoming  
Oral Presentation

*Engineering, Honors*

*Gillette, WY*

The UW Shell Visualization Center is host to the C.A.V.E. (Cave Automatic Virtual Environment), a \$2 million piece of virtual reality equipment that allows multiple people to see the same simulation. The floor and three walls are projected upon in order to immerse up to four operators in virtual reality. The C.A.V.E. currently lacks a working model of the solar system; in fact, it offers only a few demonstrative programs. To address that, Solaris VR was created. The goal of the project is to build a beautiful, realistic, and educational virtual reality solar system that can be used in the C.A.V.E. for demonstrations of the technology and for educational purposes for physics and astronomy. Solaris operates using realistically calculated physics and allows for user interaction beyond observation, like adding, changing, and deleting objects. The project is developed using the Unity Engine (C#, 2018.3.0) and is built for the HTC Vive virtual reality headset; it will be ported to the C.A.V.E. upon completion and when the C.A.V.E.'s software is next updated.

## **Synthesis and Complexation of Novel Dibenzofuran-based Pincer Ligands**

Hannah Chapin, Dr. Elliott Hulley  
Chemistry  
University of Wyoming  
Poster

*Honors*

*Buffalo, WY*

Energy waste associated with flaring of methane is a problem worth addressing. By developing a systematic means to control heterolytic activation and functionalization of carbon-hydrogen (C-H) bonds, methane could be converted into a more lucrative byproduct. This substantial energy-scale application could benefit Wyoming's and the nation's economy to capture and retain methane. Using heterolytic C-H cleavage, selective hydrocarbon functionalization (where the hydrocarbon is chemically converted into more useful products) will be readily tunable. Future work will include complexation and characterization of the activated carbon-hydrogen bond.

## **Affects of adipose PRDM16 ablation in mice**

Nicolas Chavez, Baski Thyagarajan  
School of Pharmacy  
University of Wyoming  
Oral presentation and poster

*CO-WYAMP*

*Cheyenne, WY*

Protein domain 16 (PRDM16) is a transcriptional factor that regulates thermogenic gene programming in brown and beige adipocytes. PRDM16 is an important transcription factor, which controls postnatal BAT identity and function. Beginning in the summer of 2018, as an undergraduate research student in Baskilab, I have worked on developing a mouse strain with a conditional (adipose tissue depot specific) knock out of PRDM16. Through a specific breeding protocol and a Cre/Lox system, we are able to generate a tissue specific knockout, thus completely removing PRDM16 expression in all adipose depots in wild type mice. This was done through discriminatory breeding and backcrossing of “loxP” PRDM16 genes and FABP4 cre. Selectively breeding using FABP4 Cre and PRDM16 Flox successfully knocked out PRDM16 in all adipose depots (designated as ATPRDM-16KO). After confirming the lack of expression of PRDM16 by genotyping and immunoblotting, I plan to perform a feeding study with 3 groups of ATPRDM-16KO mice, which will receive either a normal chow diet or a high fat diet (HFD, 60% calories from fat  $\pm$  0.01% Capsaicin, an agent which enhances thermogenesis and metabolic activity). At the end of the feeding regimen, mice will be humanely euthanized and their fat pads will be collected and analyzed. We will characterize the morphology and perform biochemical characterization of thermogenic pathway in these fat pads. Our study will provide a novel insight into the role of PRDM-16 in thermogenic mechanisms and will advance our long-term goal to develop novel strategies to counter metabolic diseases.

## **Smart Window Blinds**

Rui Chen and Aya Mistica with Dr. Robert Kubichek  
Electrical and Computer Engineering  
University of Wyoming  
Poster and Oral Presentation

*UW College of Engineering and Applied Science*

*Laramie, WY*

According to a survey conducted by Pew Research Center in January 2018, over 77% of American adults own or use a smartphone. Due to the growth in smartphone users, wireless technologies have become more and more integrated into everyday objects and given rise to the Internet of Things (IoT). By 2025, it is estimated that there will be more than 55 billion IoT devices. This project aims to create and design an independent IoT system allowing users to open and close their household vertical blinds with just a simple tap on their personal mobile phones or tablets. The project requires three parts involving the software, hardware, and mechanical developments. The software aspect involves a web application which allows the user to open or close the blinds as they wish. The web application communicates to the hardware unit via WiFi where the user data is received by the System On Chip (SOC), ESP8266. The ESP8266 can then send out PWM signals to the stepper motor which along with the mechanical design is able to physically move the window blinds. The web application is implemented using HTML and CSS styling uploaded to the ESP8266 web server. The ESP8266 is programmed using the Arduino IDE, and the mechanical design independently sketched and designed using Tinkercad.

## **Post-war American Anxiety in the Fiction of Kurt Vonnegut**

Johathan Chenchar  
University of Wyoming  
Oral Presentation

*English, Honors*

This paper explores Vonnegut's perceptions of society through his literary works in the 1960s, 1970s, and 1980s; what he was saying about society then, how his satire has held up in the modern day, and what the over-arching themes of his novels consist of. The paper begins with an in-depth discussion of *Cat's Cradle* and the analyzation of science and technologies role in progress, or regress, and the anxieties spurned by it. Next, *Slaughterhouse-Five* is discussed, and how Vonnegut uses his own experience in war to show the anxieties concerning the nature of war, the public's perceptions of it, and the effect it has on those who experience it. From here, *Galápagos* is analyzed, with the themes of human institutions bringing about cultural change playing a leading role, as well as the fragility of human existence from an evolutionary standpoint. Finally, the novel to sum them all up, *Breakfast of Champions* and the exploration into modern American society, and the role of the artist in a post-war society will be analyzed, leading into a conclusion on Vonnegut's portrayal of the anxieties of post-war American culture.

## **Decision Making: Identifying the Pathways Through Which Dopamine Could Affect Decision Making**

Amanda Chidester with Jonathan Prather  
Zoology and Physiology Department  
University of Wyoming  
Poster Presentation

*INBRE*

*Green River, WY*

Cognitive decision making is the process of acquiring knowledge through sensory input and using that information to choose an outcome of behavior. One example of this is sexual selection or choosing a mate. This example involves social communication so that both parties can make an informed sensory decision. In order to understand other behaviors that result from cognitive decision making, we must understand the neural circuits that take sensory information and turn it into movement. Using female songbirds, we will study these circuits based on song evaluation and mate choice. The structures we will study in the songbird brain are comparable to that of a human. This allows the findings of this project to give insight into corresponding structures in us.

**Synthesis of Cellulose by *Acetobacter Xylinum*:**  
**A Comparison of Vegan Leather to Animal and Faux Leather**  
Nikka Solatorio and Carolina Chong Liao with Professor Jennifer Harmon  
Family and Consumer Sciences  
University of Wyoming Poster Presentation

*Honors Program*

*Laramie, WY*

*Acetobacter Xylinum* is a Gram-negative soil bacterium that synthesizes and secretes cellulose during its metabolism of glucose (Cannon R.E, 2000). Microbial cellulose can be made into fabric through a series of fermentation, extraction, drying, and bleaching. The purpose of this research is to synthesize vegan leather from *Acetobacter Xylinum* in the lab and compare its properties to animal and faux leather. Materials were grown in lab for a time period of 4 weeks. The product then was sanitized, dried, and bleached for the next 12 weeks. Three ottomans were made using the three different types of leather. Discussions and comparisons of the products will address product developments such as ease of construction, price, and time. In conclusion, factors to improve the vegan leather will be further addressed.

**Porque Por Qué: Chemicals from Biomass Pyrolysis**

Thomas A. Christensen II; Ashley Frizzell; Sheridan Klock; Austin Lundgren & Alex Sawaya  
with Dr. David Bell  
Chemical Engineering  
University of Wyoming  
Oral Presentation

*Department of Chemical Engineering*

*Bufford, WY; Rapid City, SD; Williamsburg, VA; Monument CO; Lovell, WY*

Biofuels offer one alternative to traditional petroleum products as the contained organic compounds can be burned to produce energy. However, a major issue with biofuels in the current market stems from the fact that production costs are incredibly high, and margins are small. As a means of making biofuels production economically viable regardless of the petroleum market, a chemical plant with the goal to extract high yield salable products has been designed. The base case design uses a feedstock of 45,945 tons/year of wheat shells pyrolyzed to form a bio oil from which 162 tons/year of furfural alcohol can be purified and sold. This design has been modeled using the Aspen Plus simulation engine. Design alternatives that have been considered include separation of levoglucosan, methanol, furfural, and allyl butyrate. These types of separations show promise in increasing the profitability margins of pyrolyzed biofuels.

## **The ChemE Car that Cud**

Thomas A. Christensen II with Dr. David Bagley  
Chemical Engineering  
University of Wyoming  
Oral Presentation

*Honors*

*Buford, WY*

Microbial-mediated reactions are able to breakdown otherwise unusable feedstocks. However, they are usually too slow and unstable to be used for short-term production of energy or value-added products. The ChemE Car Contest, hosted by the American Institute of Chemical Engineers (AIChE), requires participants to create a shoebox-sized car powered and stopped by chemical reactions present on the car within a time period of three hours. This contest serves as an excellent testing ground for short-term biological reactions. This project is an entry into the AIChE ChemE Car Contest that showcases Wyoming's dominant industries of agriculture and mining. Rumen fluid collected from a cannulated beef cow generates biohydrogen in a microbial electrolysis cell (MEC), That hydrogen is converted to electrical power in a proton exchange membrane fuel cell (PEMFC). This electrical power propels the car and an arbitrary payload of between 0 and 500 mL of water via a DC motor. A 10  $\mu\text{Ci}$  source of cesium-137, a byproduct of uranium, generates gamma particles at a fixed rate. A microcontroller reads the total number of gamma particles measured by a Geiger counter, and triggers a relay to stop the motor at a fixed number of counts. The rate of counts observed is controlled by the amount of aluminum shielding placed between the cesium and Geiger counter. This allows the car to be stopped at any distance between 15 and 30 m. This project demonstrates that microbial-mediated reactions can be used to create a rapidly-available energy source.

## **Prolactin Stimulates $\alpha$ -Tubulin & Histone H2A Citrullination in Mouse Mammary Epithelial Cells**

Amanda Christensen  
University of Wyoming

*Chemical Engineering*

Positively charged arginine residues in proteins are converted to neutral citrulline residues by peptidylarginine deiminase (PAD) enzymes. PADs target arginine residues on nuclear or cytoplasmic proteins; yet the full consequences of citrullination on the lactating mouse mammary gland are unknown. To identify the mouse mammary gland citrullinome, we used mass spectrometry which identified 107 citrullinated proteins including histone H2A and cytoskeletal proteins  $\alpha$ - and  $\beta$ -tubulin. While citrullination of histones causes changes in chromatin organization altering gene expression, the function of citrullinated cytoskeletal proteins is unknown. Previous work from our lab shows that multiple proteins are citrullinated in the mouse mammary epithelial CID-9 cell line known to express PADs and we used this cell line as the in vitro model. CID-9 cells were pretreated with pan-PAD inhibitor biphenyl-benzimidazole-Cl-amidine (BB-CIA) followed by prolactin, a hormone that stimulates milk production by mammary epithelial cells. CID-9 cell lysates were examined by qPCR and show that BB-CIA treatment significantly decreases expression of  $\beta$ -casein, a major milk protein, and butyrophilin, a protein that helps solubilize milk fat droplets. These results suggest that that histone H2A citrullination may regulate expression of key lactation genes in mammary epithelial cells. Treatment of CID-9 cells with prolactin also increases the citrullination of tubulin in a time dependent manner. Our work suggests that mouse mammary epithelial cells depend on prolactin induced PAD-catalyzed citrullination for synthesis and secretion of milk during lactation.

## **Multidisciplinary Laboratory Water Loop for the EERB**

Robert Cincotta, Max Dickerman, Shelbi Hrkach, Adrun James, Taten Knight, Aline Muanza, and Ashley Skoog with Paul Dellenback, Lawrence Willey, David Bell, Kevin Kilty, John Oakey, Vladimir Alvarado, and Scott Morton  
Chemical and Mechanical Engineering  
University of Wyoming  
Oral Presentation

*Mechanical Engineering Department*

*Laramie, WY*

A new water flow loop teaching laboratory will be built in the Engineering Education and Research Building (EERB) during spring 2019 term. The loop will demonstrate flow in straight pipe, through elbows, the use of various instruments, and have capacity to add or remove modular section. The first modular section made for the rig will demonstrate flow through packed beds and a water hammer. The packed bed section demonstrates the difference in packing material and packing diameter, and how these parameters can affect pressure drops across the packed bed. The water hammer section demonstrates the amount of force shock waves exerted on pipe sections when a valve is closed quickly. The second modular experiment is the ell section where a comparison of 90° elbows, long 90° elbows and tees to be used to demonstrate how the geometry of fittings effect the friction losses of the system. The third modular section is the instrumental section where different types of flowmeters and valves are compared by pressure gauges and flow development. The fourth modular section is the straight run section where three different types of materials (Schedule 80 PVC (polyvinyl chloride), galvanized steel, and copper) are compared by pressure drops and flow development. The centrifugal pump will demonstrate net-positive suction head, pump efficiency, brake horsepower, and the effects of cavitating the pump.

## **Tensile Testing Grip for Subscale Specimens**

Adelaide Clarke, Andreas Eikeland, David Gray, Seth Stewart  
Mechanical Engineering  
University of Wyoming

*Honors and ME*

Traditional manufacturing methods, referred to as subtractive manufacturing, start with a large piece of material and removes material to obtain the desired shape. Subtractive manufacturing includes injection molding, machining parts, and several other methods. Additive manufacturing (AM) on the other hand creates parts layer by layer, using computer generated models. AM includes 3D printing and several other methods. For the first time ever, AM parts are being used in load bearing applications. All parts that take on a load must be tested for strength prior to implementation. MTS Systems Corporation creates testing solutions for a variety of applications and is looking to get a jump start on the AM market. MTS tasked The University of Wyoming Mechanical Engineering Senior Design Team with creating a grip suitable for testing AM specimens. The team started by researching the potential market for the proposed grip. The research concluded that specimens created using AM are substantially smaller than traditional specimens due to time and material cost restraints. The specimens commonly have a relatively low yield and ultimate strength. These conclusions led to the following design constraints: the grip had to be easy to load, carry a tensile load of at least 3 kN, and come at a reasonable cost. These goals were met by creating an automated loading mechanism and making the grip out of a carefully-selected, affordable, heat-treated steel. The result is a grip that can be marketed to the AM market for tensile testing.

## **Effects of processing parameters and geometry on the survival rate and shrinkage behavior of 3D printed SiOC polymer-derived ceramics**

Adelaide Clark  
University of Wyoming  
Mechanical Engineering  
Oral and Poster

With involved methods of manufacturing and lack of machinability, the use of engineering ceramics is limited by the manufacturing processes used to fabricate products with complex geometries. Recently, polymers fabricated via additive manufacturing which can be pyrolyzed into functional ceramics has been used to significantly expand the range of geometries that can be manufactured. Pre-ceramic polymers are a class of materials which can be heated to temperatures nearing or exceeding 800°C or “pyrolyzed” to form ceramic materials which have some associated shrinkage after pyrolysis. However, the maximum size of 3D printed structures which can be pyrolyzed is limited, as samples exceeding a critical size have a tendency to crack or burst during pyrolysis. Using a direct light projection (DLP) 3D printer, which uses a UV light to cure a liquid resin into a solid polymer material, pre-ceramic resins can be printed and pyrolyzed to generate ceramic components. In this research, a siloxane-acrylate resin which forms to an amorphous SiOC ceramic material upon pyrolysis is investigated. As this research is in its infancy, the effects of the processing parameters on the material are largely not understood. To rectify this, the effects on shrinkage and sample failure rate during pyrolysis of layer thickness of the initial print and maximum part size were investigated. It was noted that as critical geometry size and layer thickness decreased, the survival rate of pyrolyzed samples increased. With these results, failed parts during pyrolysis can be mitigated and structures can be re-designed to avoid failure.

### **Robert W. Speer and the Queen City**

Spencer Riley Claymon  
Dr. Morris, History Department  
University of Wyoming  
Oral

*Honors*

*Westminster, CO*

This project is the culmination of a semester’s long history research project. It investigates the urban and political history of the city of Denver, Colorado. It begins by looking into why and how Denver became the urban-epicenter of the Front Range, during a time in which other cities such as Golden and Colorado Springs were also being founded. It discovers that the politicking of prominent Denver-men resulted in Denver dominating the gold and silver trade out of the Rocky Mountains of Colorado. Following this it journeys through the next 40 years of Denver history during which the Colorado economy faced total economic collapse, including its capital city of Denver. The remainder of the project dives into the life and works of Mayor Robert W. Speer and how he rebuilt the city and its economy. Through infrastructure, city beautification, and politicking Speer pulled the city out of economic ruin and set in on a course for regional economic dominance. The ultimate thesis of the project is that Mayor Speer should be viewed as the second founder of the city for his efforts in saving the city.

## **Inclement Weather Detection System**

Bruce Coburn, Justin Hancock  
University of Wyoming

### *Electrical Engineering*

The Inclement Weather Detection System (IWDS) is our capstone project for EE 4830, Senior Design II. The IWDS will be a low-cost and easily-deployable module that will efficiently interpret and distribute relevant weather information. This product will be centered around a single robust microcontroller that can simultaneously support all of the interfacing and data-handling needs that is required from our various subsystems. The motivation behind us choosing this as our capstone project is that, as Wyoming residents, we are aware of how dangerous Wyoming roads and highways can be. In 2016 alone, over 2,000 Wyoming residents crashed due to inclement weather conditions. Wyoming drivers deserve to know the dangers on the road that could impact their livelihood. As it stands right now, the Wyoming Department of Transportation (WYDOT) currently has a world-class weather information infrastructure, but we feel that the IWDS can offer supplemental information to make the underlying infrastructure even better. The IWDS will supply information regarding temperature, humidity, snow accumulation, wind speed while maintaining a small form factor and reasonable cost.

## **Bell Energy Partners, Initial Project Plan: Cat Canyon Reservoir Characterization and thermal EOR Wellborne Design**

Brandon Colledge, Luis Mena, Eric Olsen, Leo Perez  
University of Wyoming

In the last two decades Enhanced Oil Recovery (EOR) methods have become essential to the economic exploitation of unconventional reservoirs. Operators have specifically taken advantage of cyclic steam injection on fields that consist of heavy oil reservoirs. One of these operators is Vaquero Energy. In 2017, Vaquero Energy completed its first horizontal well in the Sisquoc Area of the Cat Canyon Oil Field. They did so by using a wellbore design capable of taking advantage of Cyclic Steam EOR. The results have been a higher and more efficient recoverability factor of oil than previous vertical wells. BELL Energy plans to build on Vaquero Energy accomplishments by exploring methods that optimize horizontal wellbore design and Thermal EOR in the Sisquoc Area. The objective of the project will be to yield higher production numbers than previous Vaquero Energy vertical and horizontal wells. BELL Energy's Project will consist of four major phases. The four phases will be: Reservoir Characterization, Horizontal Wellbore Design, Thermal Enhanced Oil Recovery Simulation, Environmental Considerations.

**Dental Education in Wyoming Schools**  
Cally Collins with Dr. Meg Flanigan Skinner  
Physiology  
University of Wyoming  
Oral Presentation

*Honors*

*Glendo, WY*

Dental caries is the leading chronic disease affecting the youth of America (Benjamin, 2010). Dental pain, low self-esteem and absence from school are a few consequences resulting from untreated caries in youth. A healthy mouth is fundamental for learning and overall quality of life. To help combat the trend of caries - education is essential. Due to funding, students in Wyoming are no longer benefitting from the in-school screenings and oral education sessions. It has been found that oral health education provided in schools improved oral health practices, as well as decreased cavities (Haque et al., 2016). Educating in schools will provide all students and parents with tools to prevent untreated caries. It was found that once parents understood the risks of untreated caries, they increased dental visits and decreased unhealthy practices (George et al., 2017). The goal of this project is to introduce the importance of healthy mouths and the causes of unhealthy mouths to parents and their children. Another component is addressing these issues educationally and parentally. Due to the decreased funding, volunteer dental professionals and schools will be contacted to start a program in Laramie. Then a pilot study will be conducted to collect local data considering what schools would benefit and are willing to allow this program to be incorporated. The long-term goal is to influence schools and other Wyoming dental professionals to volunteer their time to educate the Wyoming youth.

**Golden-winged Manakin (*Masius chrysopterus*) Mating Display Behavioral Study**

Nicole with Nick Oakley and Dr. David McDonald  
Zoology  
University of Wyoming  
Oral Presentation

*Jackson, WY*

Manakins are a diverse family (Pipridae) of birds whose range covers a large portion of South America and Central America. Males are brightly colored in reds, blacks, blues, whites and yellows and can be from 8.5 to 16 centimeters in size. This family is of particular interest because most species have a lek mating system (like sage-grouse) in which males gather at traditional clustered courts for elaborate courtship displays. These displays include wing snaps, ultra-rapid maneuvers, and even coordinated dances between partnered males. Golden-winged Manakins, *Masius chrysopterus*, display at fallen mossy logs in the Andes of Ecuador. I helped detect certain display elements and then coded video footage of the displays, using the program BORIS. The coded behavioral elements were then analyzed as networks, to compare and contrast successful versus unsuccessful displays. I will present an overview of my participation in the research effort, highlighting display elements that shed new light on how some males become highly successful at attracting female mates. Even though the project is still in progress, one overarching conclusion is that simplicity and repetition are critical. Unsuccessful displays are more jumbled and unpredictable than the smoother, predictable sequences of key elements performed by the most successful males. I will also show dramatic high-speed video of the displays, which are so rapid that human observers see only a blur of movement.

## **Cognition and Problem Solving of Raccoons (*Procyon lotor*)**

Carissa Cooley with Sarah Benson-Amram  
Zoology and Physiology  
University of Wyoming  
Poster

*Wyoming NASA Space Grant Consortium*

*Boring, OR*

As a member of The University of Wyoming's Raccoon Project, I looked at the adaptability and problem-solving abilities of local raccoons (*Procyon lotor*). Many animals lack the ability to adapt in a continuously changing environment, which results in a conservation problem. I examined ways in which raccoons can adapt so successfully to different environments. Characteristics such as problem-solving skills and cognition seem to play a vital role in their success; therefore I studied and quantified these abilities. In addition, I investigated the social interactions of this species in order to determine whether information spreads throughout the population and how this transfer of information may have influenced problem-solving abilities. Data has been collected and analyzed from trials ran in 2016 and 2017. Trials were conducted in different areas around Laramie to have an increased population of participating individuals. By looking at different environments, I can determine if intelligence influences adaptability to changing environments.

## **Vehicle Occupancy Detection System**

Braxton Cooper, Kyler Lunberg  
University of Wyoming

*Electrical Engineering*

The Vehicle Occupancy Detection System(VODS) could potentially save 40 lives a year. VODS goal is to easily implement an inexpensive device into any car. It will detect life in the car. Once it detects life in the car, it will measure the vehicle's temperature. If the vehicle's temperature is dangerous and there is life in the car, an alert will be sent to the vehicle's owner. If the owner does not respond in appropriate time, depending on the vehicle's heat, then the system sends an emergency signal. We will use a raspberry pi zero microcontroller to control and power the motion sensor, vibration sensor, temperature/humidity sensor and of course the 3G sim card to allow messages to be sent for communication. The motion sensor and temperature/humidity sensor will detect life in the vehicle. The vibration sensor will determine whether the car is on. If the vehicle is on, the vibration sensor will not consistently check temperature. The 3G sim card is required to send notifications to the user and the police. The microcontroller will give comments power and direct their signals. A phone app will oversee what is going on within your vehicle. This product uses a low power effective design that detects humans and animals. This uses a mixture of electrical engineering as well as computer science to bring the working product all together.

## **LPU Puncture Actuator**

Tim Corley, Amanda Vinson, Chris Redinger with Dr. Kevin Kilty  
University of Wyoming Mechanical Engineering  
Kennon Products  
Oral Presentation

### *Mechanical Engineering*

Navy Aviators are required to wear life preservation units (LPUs) as an emergency precaution for drowning. To activate the life vest, two beaded handles are pulled to trigger the inflation system. In the current design, each pull string is attached to a mechanical lever arm. When you pull the string, the lever forces the puncture pin into the canister, releasing the CO<sub>2</sub> gas into the inflatable bladder. This design is inherently flawed due to the risk of the mechanism catching on bladder material, the ripcord becoming entangled with the device, and the large range of motion required by the lever interfering with surrounding objects. As a result, Kennon Products has tasked the team with designing a fully functioning puncture actuator that solves these problems. The new puncture actuator design must puncture the CO<sub>2</sub> canister to allow the bladder to inflate almost instantaneously. To improve the functionality, the team focused on a design with an internal mechanism (pre-loaded spring) and minimal range of motion mechanism (adjusted lever) to minimize interference from the surrounding environment. The original design was analyzed, actuation mechanisms were conceptualized, and two final designs were chosen. The final designs were prototyped and tested for functionality. The team will submit the final designs to the sponsor company, Kennon Products.

## **Patients' Perspectives on Telepractice Delivery of Allied Healthcare**

Josie Cox; Kirsten Kropkowski; Jenny Nybonn; Avery Walcher; Chelsea Kunitz; Autumn Ostlund; Mary Jo Hidecker, PhD, MS, MA, CCC-A/SLP; Erin Bush, PhD, CCC-SLP; Annalisa Piccorelli, PhD; and Reshmi Singh, PhD  
University of Wyoming

### *Communication Disorders*

*Elizabeth, CO*

Parkinson's disease (PD) is the second most common neurodegenerative disease, which can result in a variety of challenges (Morris, 2000). Rural communities where it is often necessary to travel hours to receive care suffer greatly. A possible solution is telepractice - the use of technology to deliver health care. This qualitative study aimed to explore the experiences of people with PD who participated in an eight-week telepractice study that provided coordinated allied healthcare, including physical therapy, speech therapy, and medication management. Individuals with PD were recruited from rural Wyoming and Nevada. Patients attended online therapy sessions from home with speech-language pathologists and physical therapists and received medication management from a pharmacist. After the intervention, patients agreed to interviews with open-ended questions about their telepractice experiences. These were transcribed and analyzed using open and axial coding. IRB approval was obtained for this research. The interviews resulted in two superordinate themes: *Patient Benefits* and *Patient Challenges*. *Benefits* included *benefits of intervention*, *benefits of telepractice*, and *enhanced symptom awareness*. *Challenges* included *technology challenges*, *lack of tech knowledge*, and *logistical challenges*. Complications with telepractice delivery for allied healthcare may occur. Finding appropriate support needs further consideration to improve telepractice. Despite complications, patients still found treatment and delivery beneficial. Many patients noted satisfaction with the allied healthcare and the telepractice delivery of it. Telepractice with older adults with PD was successful in providing coordinated allied healthcare. When providing care to this population, the use of telepractice may reduce rural healthcare disparities.

### **Micro-Wind Turbine Generation**

Grady Craft, Will Delva, Skyler Everitts, Andie Kinney, and Will Schutz with Dr. Kevin Kilty  
Mechanical Engineering  
University of Wyoming  
Oral Presentation

*Department of Mechanical Engineering*

*Sheridan, WY*

Residents of Least Developed Countries (LDC's) can extend the useful portion of their day by gaining access to reliable electrical energy. Currently, some residents rely on 12-Volt automobile batteries to provide electricity to their households. The primary objective of this project was to produce a build manual for a micro wind turbine to charge these 12-Volt batteries. Current charging sources include fossil fuel generators, micro hydroelectric systems, and photovoltaic systems. However, these options are problematic because fossil fuel systems are cost prohibitive, photovoltaic systems are difficult to produce, and micro hydroelectric generators require flowing water. For this project, the build manual details the fabrication process of a micro wind turbine utilizing readily available materials. A car alternator was reconfigured into a permanent magnet generator to charge a recycled marine or automobile 12-Volt battery. Polyvinyl chloride (PVC) piping was cut to produce the turbine blades using the design specified in the build manual. A prototype was built to verify that this design will provide 200 watt-hours per day, which is the average household electricity demand for LDC's. The micro wind turbine produced using this build manual enables impoverished communities to extend their productivity via a low cost and sustainable solution.

### **Least Developed Countries and Alternative Electrical Generation**

Grady Craft with Dr. Kevin Kilty  
Mechanical Engineering  
Honors College  
University of Wyoming  
Oral Presentation

*Honors College and Department of Mechanical Engineering*

*Sheridan, WY*

Communities in Least Developed Countries (LDC's) are often subject to major brownouts or blackouts. These power outages are caused by a lack of supply to meet the demand that the grid in these countries experience. Electrical energy in these countries is prioritized to important installations such as hospitals, government buildings, and major economic centers. In addition, power theft is a constant concern that drastically increases demand on a grid that already doesn't have enough supply to keep the lights on. Also, natural disasters can often force a country to rebuild their entire electrical infrastructure. Current solutions to this issue are generators or photovoltaic power supplies, but these solutions can carry large costs with them such as fuel costs or extensive and complex battery storage. As a cheaper and cleaner alternative to these current solutions, a micro-wind turbine could be fabricated from readily found and repurposed parts. The goal of this project was to develop a build manual for a micro-wind turbine from a repurposed car alternator and polyvinyl chloride (PVC) pipe. The car alternator was reconfigured into a steady-state permanent magnet generator and the PVC pip was cut and shaped into the turbine blade. Other components were sourced from commonly found materials such as sheet metal, metric bolts and nuts, and reused bearings. A prototype was built to verify the design detailed in the build manual. The micro-wind turbine produced using this build manual enables communities in LDC's to gain access more reliable, cleaner, and cheaper energy.

## **Remote Fire Detection**

Matthew Cramer  
University of Wyoming

### *Electrical Engineering*

Computer vision technology is evolving and being applied to different applications all over the world. Forest fire detection methods have not changed since radio communication and as the intensity and frequency of fires increase, improved detection can allow for greater ease of suppression. By combining radio communication, computer vision and smoke detection with efficient computing devices, we are able to create a device that detects fire and communicates that information to the proper officiates. The device was judged on how well it was able to detect fire and communicate the results as well the efficiency of the solar power system. The future of fire detection is rooted in new technology and devices like this will increase the safety of people in fire-prone areas.

## **The Effect of Bloom Density on the Abundance of Insects Captured in Pollinator Traps**

Maddison Crawford  
University of Wyoming

*WYNDD, Wyoming NASA Space Grant Consortium, WRSP*

Wild bees are key pollinators in most regions of the world and perform ecosystem services for many habitat types. The abundance and diversity of floral resources vary among ecosystems and may influence pollinator presence. Vane traps and pan traps are commonly used to measure the prevalence and variety of bees in an area. These traps specifically target Hymenoptera through color (blue, yellow, and white). Our study investigated the degree to which pollinating insects were attracted to vane traps and bee cups (similar to pan traps) in locations with low, medium, and high bloom densities. We collected specimens in eastern Wyoming and are currently analyzing the data. We predict that the highest abundance of Hymenoptera will be captured in vane traps and bee cups placed in areas with low bloom densities. The lowest abundance of bees will be collected in traps located at areas with high bloom densities. By measuring how floral resources effect the abundance of Hymenoptera collected in pollinator traps, we will be able to monitor the presence of bees while causing the least amount of impact to local populations.

## **Spice Up Medicine**

Fantasia Critchfield with Dr. Uko Udodong  
Chemistry Department  
Northwest College  
Poster Presentation

*INBRE*

*West Plains, MO*

Spices have a long history in medicine used for treating a broad range of ailments through natural resources. However, the active compounds in these spices have very low solubility in water. Eugenol makes up over half of the chemicals found in cloves (spice), a compound with only 2.46 mg/ml aqueous solubility at 25°C. Cloves can be used in the treatment of acne, yeast infections, as well as food poisoning, septic shock, and typhoid fever. Increasing the solubility and bioavailability of drug products are usually created through formulation or the use of prodrugs. In this research, we will be using carbohydrate derivatives to mediate solubility. With the use of glucose, mannose, and galactose as glycosyl donors, we will prepare glycosides using the active ingredients of spices as glycosyl acceptors. A change in solubility could result in a change in activity profile. If the activity profile were to increase, these altered spices could reveal more potent remedies, leading to a greater prevalence in modern medicine.

## **Melding Wyoming Research Scholars and LAMP teachers to take Science on the Road: The Science Initiative Roadshow brings student-led science and active learning to Wyoming K-12**

Olivia Croft, Ella DeWolf, Mercedes Fermelia, Tyler Myers, Jess Oldham, Brett Ralston, and  
Josh Walmsley with Rachel Watson  
Science Initiative  
University of Wyoming  
Oral Presentation

*WRSP, LAMP*

*Laramie, WY*

In 2017, The University of Wyoming Science Initiative's (SI) Learning Actively Mentoring Program (LAMP) offered scholarship support to 16 K-12 educators across the state to attend the Wyoming Department of Education's Roadmap to STE(A)M conference. As a part of this funding, educators were asked to open their classrooms to undergraduate researchers to practice active learning and excite the next generation of STEAM professionals. Seven undergraduate students hailing from diverse fields in the sciences and arts galvanized outreach efforts, and were supported by the Wyoming Research Scholars Program, LAMP, the McNair Program, graduate students, and faculty from across the UW campus. Over the last year, those seven undergraduate researchers visited six cities and led in-reach opportunities at UW, reaching over one thousand students in total. In all cases, we received a positive response from both students and faculty; in fact, the requests that we received for visits outnumbered our capability. We, as undergraduates, believe that this program - *The Roadshow* - is essential to the growth and development of human capital in our state. Yet, we are keenly aware of the fact that *The Roadshow* in its current form, is unsustainable. We hope that in gathering relevant stakeholders to discuss the results of this effort, we can work together to crystallize the Roadshow as a part of the greater institution and empower our team with the necessary resources and infrastructure.

## **Water Quality in The Big Horn Basin**

Michael F. Cuddy , Gareth G. K. Flowers, Wyatt J. Horrocks, and Eric C. Atkinson  
Chemistry Department and Biology Department, Northwest College  
Poster Presentation

*INBRE*

*Cowley, Powell, WY*

Water quality is important, especially in the Big Horn Basin, where both lotic and lentic water systems play a major role in agriculture as well as fish habitat. Water quality can be tested, in the field or lab and the results analyzed to determine the presence and source of any possible contaminants. Indicators such as pH, salinity, TDS, conductivity, and turbidity are all useful in determining water quality. We have collected data, geospatial information and water samples from several sources representative of the Shoshone River and the Clark's Fork of the Yellowstone River watersheds in the Big Horn Basin. Our data indicate that, regardless of the source, the pH remained close to 8.5, while the TDS and salinity varied by several hundred parts-per-million. This suggests that the solid and salt compounds entering these waters are not noticeably affecting acidity/basicity. We extracted DNA (eDNA) from water samples to seek insight to how organisms are affected by the water quality. Ultimately, this project aims to create a GIS map of the Big Horn Basin highlighting how water quality changes throughout the Basin.

## **Design of the Wyoming Motorsports Accumulator**

Jared Dean, Andrew Janecek-Oiler, Justin Stark with Dr. Erica Belmont  
Mechanical Engineering  
University of Wyoming  
Poster Presentation

The Wyoming Motorsports FSAE race car requires an accumulator system for its hybrid drivetrain. This system needs to fulfil all the requirements set forth in the FSAE Hybrid 2019 Rule book. A full design was developed for this application including cell type, packaging, system monitoring, and electrical performance characteristics. Near the end of the construction period, the selected battery cells were determined to have a manufacturer's defect. In lieu of the team's competition date, a working solution was required by the end of April 2019. The team decided to replace the first design, built around the defective cells, with a completely different solution. The new accumulator was to be constructed with already-assembled battery packs, and required a redesign of the accumulator containers and electrical system.

## **Engineering Near-Infrared Light-Activated T-regulatory Cells to Achieve Localized Immunosuppression**

Clara Delahaye with Dr. Mark Gomelsky and Tasneem Hassan  
Muna Molecular Biology  
University of Wyoming  
Oral and Poster  
Presentation

*INBRE*

*Jackson, WY*

Although soldiers with missing limbs and extensive burns may be helped with organ transplants, they are rejected within a few years (Sarhane et al, 2013). Our aim is to stabilize the transplants using immune suppressive t-regulatory cells. To maintain a large quantity of these cells in transplanted organs, we are developing a new therapy in which propagation of these cells is controlled by near-infrared light. The Gomelsky lab has engineered a system to control gene expression using near-infrared light due to its ability to penetrate human tissues (Verkhusha et al, 2016). The goal of this project is to transfer this system into t-regulatory cells so we can control the abundance of the cells with light. In order to move the gene regulation system into t-regulatory cells, we need to break it into two parts and deliver each part through the use of a lentiviral vector. In this study, we engineered the first lentiviral plasmid by purifying the lentiviral vector from *Escherichia coli* and subsequently digesting it. We then amplified the gene regulatory system from an existing plasmid and inserted it into the vector. We verified that the lentiviral plasmid was correctly assembled by PCR, and are now working towards engineering the second lentiviral plasmid. Both plasmids will then be delivered to t-regulatory cells, and we will test the cells for near-infrared light activation. We have made progress in the system that will be used to modify t-regulatory cells, and hope this therapy will be beneficial for future organ transplant recipients.

## **Field Effect Properties of Exfoliated Two-Dimensional Tellurium**

Isaiah De La Torre and Dr. Jifa Tian  
Physics and Astronomy  
University of Wyoming  
Poster Presentation

*McNair Scholars Program*

*Cheyenne, WY*

Since the discovery of graphene in 2004, two dimensional (2D) materials have attracted significant research interest due to their unique physical properties, such as their strong interactions with light and unique electrical properties. Tellurium (Te), a group-VI narrow-bandgap p-type semiconductor with unique 1D van der Waals crystal structure, can also form a 2D layered structure, showing intriguing electrical, thermoelectric, and optical properties. Despite the recent progresses on nanostructured Te, creating high-quality 2D Te from its bulk crystals remains a challenge owing to its 1D chain-lick crystal structure. In this project, we are aiming to develop techniques to exfoliate 2D Te with controlled thickness from its high-quality bulk crystals. The morphology and chemical composition of the exfoliated Te flakes will be characterized by different techniques, such as atomic force microscopy (AFM), scanning electron microscopy (SEM), and Energy dispersive spectroscopy (EDS). Furthermore, we will also systematically investigate the field effect (FE) properties of the 2D Te-based FE transistors fabricated by nanofabrication techniques.

**Central Wyoming College Interdisciplinary Climate Change Expedition (ICCE)**  
**Macroinvertebrate Sampling at the Dinwoody Creek Headwaters**  
Gunnar Pedersen and Jacob Dickerson with Professor Jacki Klancher  
Alpine Science Institute  
Poster

*EPSCoR and NASA*

*Lander, WY*

Changing temperatures and subsequent environmental changes pose major threat to the health freshwater resources. The Wind River Range is home to the largest concentration of glaciers in the lower 48, and has been subject to a measurable loss in glacial ice mass. This hosts implications for the quality and quantity of associated surface water. Biological monitoring of macroinvertebrate species provides a clear indicator of water quality in associated streams and waterways. An absence of pollution sensitive species such as Ephemeroptera (Mayfly), Plecoptera (Stonefly), and Trichoptera (Caddisfly) has proven the canary in the coalmine for overall stream health. An abundance of these sensitive species can reveal information on overall water health even before chemical testing has been performed. During the Interdisciplinary Climate Change Expedition (ICCE) in August 2018, seven random grab samples were collected from the headwaters of Dinwoody Creek (at the terminus of the Dinwoody Glacier) and downstream at the Little Ice Age terminal moraine. These grab sites revealed low levels of pollution sensitive species near the glacial terminus headwaters, but showed that populations increased downstream where bank vegetation is more abundant. Three composite transects were also performed - two below the terminal moraine and one near the terminus of the glacier. These composites further supported findings that pollution sensitive macroinvertebrate species are more abundant as the water travels downstream. In 2019 the study will be expanded to include ten composites located between the terminus of the Dinwoody Glacier and the stream below the terminal moraine.

**CoDeepNEAT: Automating the Architecture Search**

G. Dylan Dickerson  
University of Wyoming

Artificial neural networks (ANNs) are a popular machine learning method that have been applied to varying problems. While they are a simplified representation of biological neural networks, ANNs still require that designers consider many parameters at varying levels. The choice of layer types used, connections between layers, rate of change of weights in the network (learning rate), input transformation, and other decisions have significant impact on the efficacy of the final trained network. Based on the Neuroevolution of Augmenting Topologies (NEAT) algorithm, CoDeepNEAT automates the search for these parameters. To do so, CoDeepNEAT co-evolves a population of blueprints with a population of modules that describe the topology and parameters of an ANN when combined. Using blueprints to describe high-level parameters and how modules are connected along modules to describe the connections between layers, allows CoDeepNEAT to evolve deeper networks of different types than NEAT. This project will test CoDeepNEAT with the MNIST digit recognition and CIFAR-10 object recognition datasets.

## **Crude Unit Fouling Mitigation and Furnace Design**

Shane Dilsaver, Michael Downey, Michael Hoversland, Micah Iribarren, Kaytlin Marrill  
University of Wyoming

The Sinclair Casper Refining Company has been experiencing issues with asphaltenes precipitating out in the crude they are receiving from crude blenders. These crudes are forming emulsions in the desalting equipment and fouling the crude unit heat exchangers, heater, and atmospheric distillation tower. Research has been conducted into how to eliminate asphaltenes from opportunity crudes to allow for desalting and minimize any fouling in the crude unit heat exchangers, heater, and atmospheric distillation tower. Rather than add a unit to eliminate asphaltenes from the crude, crude furnaces have also been designed to replace the current furnace at the refinery. The crude furnaces and deasphalting unit must both be built for 50,000 BPD production. One furnace would handle opportunity crudes with the asphaltenes, and the other would only be able to handle more expensive virgin crudes. These furnaces are designed to operate without the deasphalting unit that was also designed. Research was conducted into the best way to deasphalt the crude. After finding multiple options the Residuum Oil Supercritical Extraction (ROSE) process was the most suitable. The ROSE process uses liquid solvent to dissolve the asphaltenes which are then separated from the deasphalted oil. The design also used economic analysis to determine the economic viability of each option, as well as which option was the best for the refinery.

## **Providers' Experiences on Delivering Telepractice for People with Parkinson Disease**

Haley Dollerschell with Dr. Mary Jo Cooley Hidecker and Dr. Erin Bush

Division of Communication Disorders

University of Wyoming

Poster Presentation

*Division of Communication Disorders*

*Stoneham, CO*

Parkinson's Disease (PD), a neurological disorder that impacts motor movements such as walking and talking, has no cure. Due to this, different types of treatments are essential to reduce symptoms and improve quality of life. Patients with PD living in rural areas have difficulties receiving necessary care, partially due to the lack of providers in their area. Providers specializing in PD, such as speech-language pathologists (SLPs), physical therapists (PTs), and pharmacists, are challenged with delivering treatment, despite this lack of access to patients. For our study, we used a web-based platform, telepractice, to provide speech-language therapy, physical therapy, and pharmaceutical interventions to people with PD. The aim of this study was to explore the perspective of providers regarding their experiences providing a novel-eight-week coordinated allied healthcare intervention for patients with PD. At the end of the study, 6 providers were interviewed about their experiences. The interviews were transcribed verbatim and a qualitative descriptive analysis method was used to refine and complete the coding of emergent themes. Results from our qualitative analysis are represented by three main themes: *Provider benefits of the intervention*, *Provider benefits of the delivery model*, and *Technology challenges*. The providers found that telepractice was an effective and successful way to deliver coordinated, allied health intervention. With improved technology and increased access to sufficient internet, telepractice is a feasible way for providers to deliver services to people with PD who live in rural areas.

## **Cellular Regulation through Optogenetics: Light Activated Adenylate Cyclase in Mammalian Cells**

Paul Duale  
University of Wyoming

### *INBRE*

Cellular therapy as a means of addressing systemic human diseases is a growing discipline within the medical field. One challenge within this new and exciting discipline is a reliable and safe method of controlling cells to successfully utilize them as therapeutic agents. Optogenetics, or the control of cellular regulation through application of light, has the potential to be a solution to this challenge. The development of a near-infrared light activated adenylate cyclase that has been optimized for use in mammalian cells begins to allow for the potential of optogenetic control of cellular functions for therapeutic purposes. Through the control of the engineered adenylate cyclase, and the corresponding production and release of cyclic AMP, cellular processes and behaviors can be regulated through exposure to near-infrared light. This presentation will focus on the development of the light-activated adenylated cyclase, *Iam5*, its incorporation and expression into mammalian cells, and potential therapeutic purposes in human health and disease.

### **Chance Sounds: Is it music?**

Rebecca Dulaney Anne Guzzo  
University of Wyoming Music Department  
University of Wyoming  
Poster

### *McNair Scholars Program*

*Sundance, WY*

This study will seek to determine whether or not sounds left to chance, and then organized can be considered music. It is hypothesized that students will decide that the sound presented to them is something they would define as music when it is compared to other genres. Ten college students, ages 18 – 27, will partake in an informal interview. In this interview, students will be asked about qualities that make certain sounds music, listen to a piece created with all variables being left to chance, and then answer whether the music had the qualities stated previously or not. Interviews will conclude with participants answering if the piece they have heard is music. The piece used in testing will be composed with sounds that are recorded from “everyday life” and following styles of well-known composers such as John Cage. By discussing the aleatoric genre alongside “typical” music, composers and teachers can determine how to develop and teach it, in order to be considered music.

## **Drain Drone**

Tyler Eatherly with Dr. Robert Kubichek  
Electrical Engineering  
University of Wyoming  
Both Oral and Poster Presentation

*Running Springs, CA*

Pipe systems have underpinned modern civilization for centuries, but if a pipe malfunctions, it can be labor intensive to diagnose and correct the problem. Most pipe repair methods require either blindly sending a tool downpipe or digging up stretches of pipe to find the problem. The former requires luck and is often indelicate; the latter can be very costly, and sometimes is impossible. There are a handful of diagnostic tools in the market, but they are expensive and complicated. Our device attempts to alleviate much of the cost and difficulty associated with diagnosis and is cheaper and simpler than alternative devices. Our design is a user-operated, mobile camera that can be sent inside a pipe and send live, illuminated video back through cable to a screen on a handheld controller. The cable is marked with measurement increments to determine the depth of the device in the pipe. Pipe breaks or blockages can be located using the depth information and video feed. For traversal, the device has four arms, two going each direction in X and Y axis, that suspend the camera in rough center of the pipe, off of trickle or detritus. Each arm ends in a motorized wheel for grip and movement. The device is powered by an AC/DC wall adapter.

## **The Severity of Toxoplasmosis infection and Parasite Burdens**

Makayla Eatmon, Charlee Houghton, Philicia Hupp, Richard Magarian, Katelyn Randall with  
Marie N. Yearling, Ph.D.

School of Math and Science  
Laramie County Community College  
Poster Presentation

*Toxoplasma gondii* is a protozoan parasite that causes a disease known as Toxoplasmosis. It is estimated to infect 11% of Americans and is a leading cause of foodborne illness in the United States. Symptoms of infection vary among individuals and are thought to partially depend on the patient's immune system and the parasite strain. Even still, individuals with healthy immune systems may experience severe outcomes. Indeed, we observe a range of toxoplasmosis severity in genetically identical mice infected with the same parasite strain. Given that infection occurs orally, we focused our investigation on the relationship between intestinal microbiome and infection outcomes. Our role in this project is to determine parasite burden, which can be compared with pathology and microbiome composition data collected in our collaborator labs. We used qPCR to evaluate parasite load from mouse spleen, small intestine, feces, and brain at both acute and chronic infection. If a correlation is observed, further research will investigate the infection outcomes following the depletion of the mouse microbiome.

## **Implementing a medical program for Children's Relief International**

Jenni Ebersberger with Dr. Brian Cherrington

Physiology

University of Wyoming

Oral Presentation

*Honors College*

*Laramie, WY*

Children's Relief International (CRI) is a non-profit organization whose mission is to take the Light of Christ to the poor in Africa and India. Currently, there is no medical program associated with CRI. In this paper, the relationship between poverty and health conditions in CRI partnership countries such as Malawi, Mozambique, Uganda, and India are investigated. These third world countries are poverty stricken, which has a direct effect on adverse health (Wagstaff, 2002). For example, poor countries tend to have worse health outcomes related to nutrition, environmental exposure, chronic illness, and language development as compared to wealthier countries (Khullar & Chokshi, 2018). Given the present conditions in CRI's partner countries, there is a clear need for medical aid. Other organizations with a similar vision to provide healthcare to rural areas in Africa, like FAME, will be considered when addressing the development of CRI's medical program (fameafrica.org). Specifically, the implementation of a basic mobile medical clinic will be investigated. A medical program for Children's Relief International would benefit the people in CRI's specific partnering locations, providing medical care for local impoverished residents.

## **Charlton 30/31 Field Development Plan**

McLean Eddins, Gartett Lynch, Tanner Luthy, Noah Rivera, Jean Yazou

University of Wyoming

The purpose of this project is to develop a static model that will help determine new production zones for the Charlton 30/31 oilfield for the drilling of additional boreholes. This field has been producing for about 40 years, but production has declined steadily since then. With our research we intend to propose a well plan that will be an economically viable project. To complete the project, we have divided the project into multiple phases, using different programs and resources at our disposal. The phases include planning, creating a static reservoir model, field development, and economic analysis. In the project planning phase, we created an ideal project timeline to stay on track. During phase two with the creation of a static model using petrel and the associated project data we were able to assess the model for optimal well location. Once the well location was selected we designed a well path and wellbore design that would be implemented to drill and complete the well. Creating a drilling and completions plan included research on the areas lithology and current tools that could be used to efficiently complete the project. With a drilling and completion design we then created a cost analysis of the project, using former field production data we estimated a value for the project. From this project we were able to analyze a declining asset for further revenue potential and create a plan and design a well that could be utilized to carry out the objective of developing the Charlton 30/31 Field.

## **Investigating the Link Between Melanism and Immune Function of Canids and the Presence of Bacterial Taxa**

Emilie D. Edwards and Eric C. Atkinson  
Department of Biology, Northwest College  
Poster Presentation

*INBRE*

*Cody, WY*

The documented cause of melanism in most species of mammals, fish, and birds is caused by a mutation in the Melanocortin 1 receptor (Mc1r) gene. However, in wolves (*Canis lupus*;  $n=8$ ) and coyotes (*Canis latrans*;  $n=10$ ), it is caused by a mutation in the K-locus, which encodes the beta-defensin protein that acts as an alternative ligand for the Mc1r gene. These beta-defensin proteins are important factors that help to link the innate and adaptive immune responses. Bacterial DNA is left behind even after the disease has run its course, so it is possible to sequence using PCR techniques and identify the taxa present. We are testing for the presence of bacterial taxa in K-locus heterozygous (Kk) and homozygous (kk) individuals to see if there is a statistically significant difference between melanistic and non-melanistic canids effected by bacterial disease.

## **Characterization of Perceived Muscle Soreness and Prediction of Skeletal Muscle Markers of Damage Following a Bout of High Intensity Exercise**

Lauren N. Elliott, Brittney M. Wells, Nicole M. Sauls, Evan C.  
Johnson Department of Kinesiology and Health Promotion  
University of Wyoming  
Oral and Poster  
Presentation

*INBRE & Honors*

*Cheyenne, WY*

Exercise-induced skeletal muscle damage often resolves in 1-5 days, however severe complications occasionally arise. Identifying predictors of severe muscle damage may reduce potential risks associated with high volume or extended duration workouts. Determine if pain perception is related to markers of skeletal muscle damage following a standardized HIRFT bout. Participants ( $n=19$ [13 males,  $174.7\pm 7.9$  cm,  $77.9\pm 13.7$  kg,  $25.8\pm 6.5$  y, training experience  $3.5\pm 1.3$ y] completed a standardized HIRFT workout (1 mile run, 100 pull ups, 200 pushups, 300 air squats, 1 mile run). At 5 timepoints (24h pre, immediately pre, immediately post, 24h post and 48h post exercise), participants completed the Short Form McGill Pain Questionnaire (MPQ), including responses to 15 pain terms and a visual analog scale (VAS). Plasma osmolality (Posm) was measured from blood samples taken at each of the above timepoints. RMANOVA revealed a main effect of time for 11 pain descriptors, VAS, and Mean Plasma Osmolality (all  $p \leq .035$ ). A stepwise regression analysis revealed a significant relationship between VAS immediately post exercise and mean plasma osmolality 48h post exercise. Eleven MPQ terms best described perceived muscle pain following the HIRFT bout. The relationship between VAS immediately post and plasma osmolality 48h post exercise demonstrates individuals who perceived more pain immediately following workout showed evidence of increased skeletal muscle damage 48h after the workout. This muscle damage may be due to a release of urea from the skeletal muscle cell following exercise. Findings indicate perceived muscle pain may be a valuable predictor of muscle damage.

## **Powder River Polyolefin Plant: Crude stripping and processing of light end materials into polyethylene and polypropylene**

Brittany Endsley, Caleb Richmond, Emily Lynch, Richard Wise, Seth Harris

*Department of Chemical Engineering*

*Laramie, WY*

The Powder River Basin (PRB) is expected to have a major increase in crude oil production over the next several years. With this potential increase, it is possible that the additional production could exceed the current pipeline capacity. Therefore, to transport the crude oil, it is necessary to ship by rail. Use of the railroad is a feasible alternative transportation method due to the shipping capacity of the railroad, due to local coal mining. However, as a result of the light, volatile crude oil, there are safety concerns about railroad transportation. The State of North Dakota requires that oil shipped by rail has a Reid Vapor Pressure less than 13.7 psi. To reduce the RVP to acceptable levels for safe transportation, the crude oil needs to be stabilized by removing volatile hydrocarbons. Doing so creates potential to use the removed hydrocarbons as a feedstock for a polyolefin production facility. This facility will include the crude oil stabilization unit, a steam pyrolysis unit, olefin separation units, and polymerization units. The crude stabilization unit is used to reduce the vapor pressure of the crude oil to acceptable transportation levels by stripping volatile hydrocarbons from the oil. The stripped components will then be converted from paraffins into olefins and furthermore into polyolefins, such as polyethylene and polypropylene. The produced polyolefins can also be transported by railcar. The construction of this operation is necessary for the transport of crude oil from the PRB and is a viable option to expand industry in the area.

## **Cell Printing in Complex Hydrogel Scaffolds**

Cassidy Enloe with John Oakey

Chemical Engineering

University of Wyoming

Oral Presentation

*Chemical Engineering*

*Big Horn, WY*

Tissue engineering describes the therapeutic regeneration of tissue damaged due to injury or deterioration. Most tissue engineering strategies rely upon a combination of cells and biomaterials to create a synthetic construct that will immediately restore lost function while slowly evolving into natural tissue. Approaches to tissue engineering have become more refined as advancements in microfabrication of soft materials have been adopted. These advancements have enabled the generation of novel synthetic tissue structures, however it is challenging to create the microarchitecture that is needed to reproduce the morphology and function of natural tissue. This project explored the fabrication of composite polyethylene glycol (PEG) hydrogel tissue scaffolds with custom microenvironments for cells and an independently defined physical and mechanical architecture needed to recapitulate the correct morphology and function of tissues. PEG microenvironments were patterned with a digital micromirror device to optically fabricate single cell-containing microgels of varying size and chemistry to better understand the variables affecting 3D printing of tissues at cellular resolution. Using this approach, composite PEG structures were created and stress/strain tested to understand their bulk structural properties. This investigation enabled the creation of mechanically customizable microengineered tissues, with the promise of 3D printing fully synthetic engineering tissues.

**Laramie 20 Years after the Murder of Matthew Shepard: A Legacy of Compassion,  
Community, and Hope**

Jess Fahlsing with Dr. Erin Abraham  
Gender and Women's Studies and Psychology  
University of Wyoming  
Oral Presentation

*Honors College*

*Rock Springs, WY*

Matthew Shepard's memorial bench on the University campus reads, "He continues to make a difference." This is what we hoped to achieve with the Matthew Shepard Memorial Group as we remembered and honored his legacy. This is also what I hope to continue with my Honors Project. October 2018 marked the 20<sup>th</sup> year since the murder of Matthew Shepard. As a subcommittee of the Shepard Symposium on Social Justice, the Matthew Shepard Memorial Group put together a series of events and performances to honor Matthew's legacy. Creating curriculum to offer First Year Seminars, English 1010, and students on UW's campus and surrounding communities was crucial. The committee itself was diverse, composed of University faculty, staff, and students as well as Laramie's City, community, and community college. The Memorial was meant to be intersectional and inclusive beyond the LGBTQ+ community, honoring all those with marginalized social identities. We hoped to create something that would live on and continue to have impact, much like Matthew's legacy itself. My Honors Project incorporates my service on the committee as co-chair (along with Dr. Emily Monago as Chief Diversity Officer). I hope, with the project, to focus around a framework of a "how to" guide for service and activism. This will be one of the first service and reflection projects the Honors College oversees, making it an important reference for future students. I aspire, with this project as well as with the Memorial itself, to continue Matthew's legacy of compassion, community, and hope.

**Winkleman Winder**

Ben Falk, Joe Kindler, Zach LaCombe, and Vickum Sidath, mentored by Dr Kevin Kilty  
Mechanical Engineering  
University of Wyoming  
Oral Presentation

*BSME, Senior Design*

*Laramie, WY*

Today, machine knitting is steadily gaining popularity for textile hobbyists. Currently, there is no consumer level device that produces a conical spool of yarn, the ideal geometry to unwind from. As such, a machine was designed and developed to wind cotton, wool, and acrylic yarn materials at 300 meters per minute, one-third of common industrial speed. Research was done with manufacturers, machinists, knitting experts, and potential customers to form a design and price for the final product. From this, a DC motor was chosen to spin an aluminum drum and a cardboard cone utilizing a method of winding known as a random winding method. The motor is powered through a power supply for safe consumer use. A disk tensioner, that can be manually adjusted, applies tension to the yarn before being wound to the spool. A pulley system with a timing belt and 3:1 ratio increases the output speed of the motor, which is regulated using a speed controller. Using these components, an efficient, reliable and safe prototype was produced. Although more testing of the current prototype is needed to find improvements for future models, the current version has met all criteria. This machine benefits small business and individuals because it allows them to make their own conical spools of yarn saving time, money and providing a better machine knitting experience.

## **Climatic and Paleobotanical Analysis of the Eocene Thermal Maximum 2 in the Bighorn Basin, Wyoming, USA**

Sarah Nicole Fanning with Dr. Ellen Currano

Botany

University of Wyoming

Oral Presentation

*Wyoming Research Scholars, Botany*

*Thornton, CO*

Eocene Thermal Maximum 2 (ETM2) was a hyperthermal event that occurred approximately 53.7 million years ago. The carbon isotope excursion and global warming during ETM2 are about half as large as during the Paleocene-Eocene Thermal Maximum (PETM, 56 million years ago). We expect floristic change during ETM2 to be less severe than the nearly complete turnover seen during the PETM. Quantification of floral change during this smaller hyperthermal will help reveal how floral change in mid-latitude North America scaled with warming of different magnitudes and herbivory analysis will provide information on insect diversity. The sites in the Bighorn Basin, Wyoming are in the upper part of the isotope excursion associated with ETM2. The two most abundant morphotypes at the most diverse site are *Platanites raynoldsii*, representing 36% of the flora, and an unnamed fabaceous morphotype, representing 13%. During the the PETM, Fabaceae are diverse and abundant, whereas taxa like *Platanites raynoldsii*, which are common in the Western Interior during the Paleogene, are absent. Leaf margin analysis yields a mean annual temperature estimate of 13.4 °C, warmer than the early Eocene cool period that precedes ETM2 (~11°C), but cooler than the PETM (~20°C). Comparing the ETM2 site with other early Eocene floral sites in the basin, we find it contains a mixture of stratigraphically long-ranging leaf types as well as a number of leaf types typical of the PETM. Less forcing of carbon cycle and climate during ETM2 than the PETM appears to have produced a lower level of floral turnover.

## **Aerospace Research Group**

Cameron Ferrarini, Robert Kemper, Connor Leyshon, Kevin Medders with Dr. Kevin Kilty

Mechanical Engineering

University of Wyoming

Oral

*Senior Design*

*Laramie, WY*

The goal of this project is to compete in the Argonia Cup Collegiate Rocketry Competition. The competition involves sending a payload of a golf ball to at least 8000ft on a rocket-propelled vehicle, and returning the golf ball to a predetermined target point on the ground, while falling at a vertical rate of no more than 30 ft/s. A rocket and payload return system were designed. The rocket follows standard model rocketry designs, but the payload return system utilizes a custom parafoil controlled by two servo motors, guided by a custom on-board computer. Various telemetry systems are used in the guidance system, including GPS, accelerometer, gyroscope, and altimeter systems. These systems serve to guide the payload return system to the ground autonomously. At apogee, the parafoil will be deployed, and the payload return system will bring the entire rocket, with the golf ball, down to the predetermined target point.

**Electron Spin Resonance of Magnetic Two-Dimensional Covalent Organic Frameworks**  
Abigail A. Firme<sup>1</sup>, Valerie A. Kuehl<sup>2</sup>, Joseph R. Murphy<sup>1</sup>, John O. Hoberg<sup>2</sup>, William D. Rice<sup>1</sup>  
Physics Department<sup>1</sup> and Chemistry Department<sup>2</sup>  
University of Wyoming

Two-dimensional (2D) materials have generated significant interest because of their unique electrical, optical, and magnetic single-layer behaviors. However, the inability to add electrical or magnetic dopants to a substantial set of 2D materials hinders their ability to be incorporated into device architectures. Here, we synthesize 2D covalent organic frameworks (COFs) that have a lattice of nanopores, which we are able to synthetically fill with magnetic ions ( $\text{Mn}^{2+}$ ) that are hexagonally arranged. We use a host of characterization techniques, such as x-ray diffraction, TEM, NMR, and FTIR, to demonstrate that our COFs are ordered, nanoporous, and 2D. Magnetic ion filling is empirically shown through electron spin resonance measurements. Unlike the unfilled COFs, which have a single peak at  $g=2.0$ , the Mn-filled COFs show a hyperfine-split, sextet of peaks with a spin relaxation time of  $\sim 5$  ns and a 10 mT exchange splitting. The ability to chemically change the nanopore spacing and the inter-ion distance, combined with our confirmation of the hexagonal  $\text{Mn}^{2+}$  ion arrangement, suggests the possibility of using these 2D COFs for potential quantum spin liquids or in magneto-optical devices.

**Powder River Basin Hydraulic Fracturing Optimization**

Alexandra Fisher, Jessica Koivupalo, Jesse Gillenwater, Jaden Montoya, and Dean McClure  
Tawfik Elshehabi  
Petroleum Engineering  
University of Wyoming  
Oral Presentation

*Petroleum Engineering Department*

*Laramie, WY*

The Powder River Basin Hydraulic Fracturing Optimization project explored two separate wells located in Campbell County, Wyoming. Data was collected on these wells from the Wyoming Oil and Gas Conservation Commission. The completion data from the Dilts 42-11 TH was used in conjunction with logs from the Dilts 44-15 TH to create a fracture propagation model. This model served as the basis for the optimization plan, and was built upon by altering fracture variables while considering the economic impacts of each alteration. Literature has been reviewed to identify possible variables worth altering such as: stage length, stage spacing, proppant, fluids, and number of perforations. The software MFrac, produced by Baker Hughes, assisted in the creation of the fracture propagation model and the optimization process. The goal was to optimize the Dilts 44-15 TH, and to create a reference for future completion plans.

**NFL Football Helmet Pendulum-Impact Ram (PIRam)**  
Sean Fisher, Scott Kuse, and Jason Young with Dr. Carl Frick  
Mechanical Engineering  
University of Wyoming  
Senior Design Poster Presentation

*EPSCoR*

*Laramie, WY*

Head injuries, namely concussions and CTE, are major concerns for football enthusiasts. With leading research indicating that repetitive impacts have severe impacts on the brain, innovations in helmet technology are necessary if football is to survive. Liquid Crystalline Elastomers (LCEs) have vastly superior energy dissipation properties relative to traditional elastomers. Preliminary findings and results reported in scientific literature indicate its high potential for use as a damping material, particularly in impact mitigation. Utilization of LCEs in protective helmets alongside or replacing the energy dissipating liner can lead to improved helmet design. The goal of the is project was to design, build and implement a gravity-driven pendulum impact ram that is compliant with current NOCSAE and NFL safety testing standards to evaluate the efficacy of using LCEs in football helmets. This design combines a gravity driven pendulum to simulate impact, a linear motion bearing table that simulates the motion of a head and torso post-impact, as well as the integration of a full 6-degree of freedom system to evaluate impact data. Preliminary findings, in association with research done by undergraduate students evaluating the efficacy of LCEs in helmets who were funded by Wyoming NASA Space Grant Consortium, NASA Grant #NNX15AI08H, indicated that LCEs may help to mitigate impacts incurred by players on the football field.

**A Pilot Study on Conversational Speech Differences Between Transmen with and Without Hormone Replacement Therapy**

Chris Folsom with Michele Bird  
Zoology and Physiology  
University of Wyoming  
Oral Presentation

*Honors*

*Chugiak, AK*

Transgender individuals have offered researchers important and otherwise unattainable opportunities to study the behavioral effects and functions of sex hormones in human adults. Furthermore, testosterone's role has been heavily implicated in language processing in a variety of studies (Lombardo et al, 2012; Wolf et al, 2000). In conjunction with this, a recent study on transmen analyzed before and after undergoing four months of high-dosage testosterone hormone replacement therapy (HRT) observed considerable changes in both the gray and white matter brain regions associated with speech production, a trait which has been found to be distinguishable between the sexes (Hahn et al, 2015; Signh et al, 2001). Presently, it is uncertain if sexual differentiation of speech is rooted predominantly in social and cultural factors or biological influences, and this study hopes to open the door to understanding this. The goal of this project is to determine if there is a statistically significant difference between the speech patterns between transmen who have not undergone HRT and transmen who have. We have transcribed the speech of a group of transmen that have never been exposed to HRT and a group that has undergone HRT for more than six months. We then used Sigh's Lexical Richness Measure to compare the two groups due to its success in differentiating male and female speech patterns.

## **Student Perceptions of the Purpose of First Year Seminars**

Ashley Foltz with Dr. Janel Seeley

Molecular Biology

University of Wyoming

Oral Presentation

*Honors*

*Lewistown, PA*

First Year Seminars (FYS) are an integral part of the First Year Experience (FYE) that is part of many college and university curriculums and degree programs. They are in place to help with retention-and help at-risk groups succeed; making them more important than other first semester or year courses (Potts & Schultz, 2008). Paying attention to what students think is important when determining success and efficiency of programs that involve them. However, studies on FYS programs are often lacking in student perceptions. Students often feel that their individual opinion does not matter at the institutional level (Soiferman, 2017). The goal of this project was to determine what students believed the purpose of FYS to be at the University of Wyoming. Surveys were distributed to Fall 2018 FYS students and interviews were held with upperclassmen. Looking at the surveys from the current first year students, their perception of purpose was categorized using key words that were used in the responses. Interview responses were sorted into classes and then categorized using the same key words as the survey responses. Understanding students' perception of the purpose could help improve FYS at the University of Wyoming.

## **A Geologic Companion to John McPhee's *Rising from the Plains***

Logan Fox, Henry Hoes, Jiwei Kang, Louise Mallon, Hollis Marriott, Patrick Megown, Blaire Voss

Mentors: Alex Sivitskis and Carol Frost

Department of Geology and Geophysics

Oral and Poster

Wyoming has a rich geologic heritage, including sweeping vistas, iconic fossils, energy resources, and ancient rocks formed when our planet was young. Wyomingites treasure their state's geoheritage for its aesthetic, cultural, historical, ecological, economic, recreational, and scientific value. The goal of our project is to deepen the Wyoming residents' and visitors' understanding of the landscape by combining Earth science with human experience. Our premise is that by combining a familiar and enjoyable activity—reading—with an engaging visual product about the geology behind the landscape, we will promote a greater connection, appreciation, and stewardship of Wyoming's geoheritage. Our project builds upon a well-known book by John McPhee set in Wyoming. *Rising from the Plains* (1986) blends the stories of a young school teacher who arrived in rural Wyoming in 1905 and of her son, geologist David Love (1913-2002), with evocative prose describing the majesty and scientific significance of Wyoming geology. Our "Geologic Companion to *Rising from the Plains*" illustrates important geologic features described in the book with maps, photographs, concise explanations of the rocks and their formation, along with the human dimensions of these places. We constructed a web-based Story Map that is accessible on computers, tablets, and mobile phones. Our "Geologic Companion" enables viewers to couple McPhee's narrative of discovery with their own personal discovery of the narrative of landscape, and to increase their geoheritage understanding.

**Central Wyoming College Interdisciplinary Climate Change Expedition (ICCE): Ground Penetrating Radar Data Collection on the Dinwoody Glacier**

Aaron Strubhar, Tobias Osborne Adam Frank, Zac Giffin,  
with Professors Darran Wells, Andrew Parsekian and Jacki  
Klancher Alpine Science Institute  
Central Wyoming College

*EPSCoR, INBRE and NASA*

*Lander, WY*

The glaciers of the Wind River Range contribute essential runoff to both eastern and western water resource regions. The resulting meltwater is essential for downstream users, especially during the dry summer months when little precipitation falls. Glacial snow and ice melt replenishes aquifers, is utilized for agriculture, and is vital to wildlife for both habitat and sustenance. There have been several studies performed on alpine glaciers in the Wind River Range, with particular emphasis on the Dinwoody Glacier (located at the base of Wyoming's tallest mountain-Gannett Peak) The Interdisciplinary Climate Change Expedition (ICCE) hosted by the Alpine Science Institute at Central Wyoming College has been utilizing ground penetrating radar (GPR) to collect depth measurements along a specific transect of the Dinwoody Glacier for the past four years. GPR data from these expeditions offers detailed subsurface imaging of a section of the ice that was first measured in the mid 1980's. The results from the initial 2015 survey demonstrated some inaccuracies but data from 2016-2018 has proven replicable and revealing. During the 2018 field expedition the GPR team repeated the original 1.6 km transect on the Dinwoody Glacier and initiated four additional short vertical transects. The team also completed a new transect across the Gannett Glacier, the largest glacier in the Wind River Range. All GPR data was collected using a Noggin 100 MHz antenna. The transect data was processed with the assistance of Andrew Parsekian at the University of Wyoming using Reflex GPR and seismic processing software.

**“A Comparison of the skills required, acquired, and desired from First Year Seminar Courses at the University of the Wyoming”**

Haley Fried, Janel Seeley  
University of Wyoming  
Oral/Poster

*Honors College/ECTL*

*Highlands Ranch, CO*

The purpose of First Year Seminars at the University of Wyoming is to aid in the transition between high school and college and help first year students get acclimated to the academic rigor of college courses. The University of Wyoming outlines the learning objectives for the First Year Seminar which include accessing diverse information through focused research, active discussion, and collaboration with peers, separating facts from inferences and relevant from irrelevant information, and explain limitations of information, evaluating the credibility, accuracy, and reliability of conclusions drawn from information, recognizing and synthesizing multiple perspectives to develop innovative viewpoints, analyzing one's own and others' assumptions and evaluate contexts when presenting a position, and communicating ideas in writing using appropriate documentation. In our research, we asked students whether they found their FYS useful and how engaged they were with the course material. Students listed beneficial skills like transitioning to college, study skills, writing skills, research skills, discussion, learning about resources, and professional skills. Through interpreting the data in our research, we found that the listed learning objectives do not match what students find beneficial to their learning. Our findings can be used to enhance student success in First Year Seminars in the future by providing recommendations for further research and for implementation into course curriculum.

## **Installation and Trial of Light Diffusers at the Wyoming Infrared Observatory**

Dax Galloway, Hannah Jang-Condell, and Cristilyn Gardner

Physics and Astronomy

University of Wyoming

Poster

*Honors Program and McNair Scholars*

*Omaha, NE*

We will be testing the proficiency of light diffusers that will be installed in the Wyoming Infrared Observatory (WIRO) over multiple broadband optical filters for observing the atmospheres of transiting exoplanets. Performing observations on transiting exoplanets with multiple optical filters results in different light depths. These variances in depth allow for insight into the composition of the atmosphere of transiting exoplanets. In response to the existing focusing limitations of the observatory, the installation of the light diffusers will allow for more precise measurements on transiting exoplanet atmospheres. The light diffusers that will be installed reduce errors in the observatory's photometry, such as non-uniform pixel response in the camera. The installation and experimentation of the light diffusers will demonstrate more precise capabilities of WIRO for exoplanet research.

## **The Effect of Mid-Flight External Perturbation on Landing Mechanics**

Aaron Gann with Dr. Boyi Dai

Department of Kinesiology and Health

University of Wyoming

Oral Presentation and Poster

*INBRE*

*Cheyenne, WY*

Most sport maneuvers are in response to a sports environment; this study is designed to observe and quantify the effect of external perturbation to the trunk on landing mechanics. With most ACL injuries being non-contact, the long-term objective of this study is to understand the effect of external forces that cause stiff landings in order to effectively prepare athletes during these situations, preventing knee injury. It's hypothesized that a perturbation force with a greater magnitude and greater distance from the pelvis will result in more asymmetric landing patterns associated with greater loading for knee ipsilateral to the perturbation forces. The investigators are currently collecting and analyzing data. Mid-flight external perturbation further from the pelvis has been observed in a small subject group to cause greater landing force in knee ipsilateral to said force. The results of this research will provide useful information about the ACL injury mechanism that occurs with mid-flight external perturbation and may help develop an effective injury prevention program.

**From Landscape to Lifestyle - Using Land Features and GIS to predict High Elevation  
Bison Jump sites in the Greater Yellowstone Ecosystem**

Mara Gans  
Central Wyoming College

The Dinwoody Bison Jump, located at 11,000ft, in the Northern Wind River Mountains, is 2,400ft higher than the next highest documented bison jump site. Bison Jumps are typically regarded as a plains phenomenon, which makes this site an archeological anomaly. If it is unique, it is merely interesting, but if other similar sites are found it becomes an indicator of a regional hunting strategy. This presentation explores the process through which environmental characteristics were used to create a predictive model to aid in the discovery of additional high elevation bison jumps - which would change the way we understand the Native American presence within the Greater Yellowstone Ecosystem. This model has been applied across the Wind River Mountain Range and Yellowstone National Park to guide researchers as they search for additional alpine bison procurement sites. This talk discusses the process of building this model and preliminary testing of the model in the Northern Wind River Range.

**Application of Bismarck Brown Y dye as a short-term biological marker**

Colton Webb, Brody Garner, William Fetzer, PhD, Steve Gale

Department of Zoology and Physiology

University of Wyoming

Poster

*Wyoming Game and Fish Department*

*York, NE*

To effectively make sound management decisions, population estimates are critical for fisheries managers. However, they can be difficult to obtain for small fish species. We conducted a laboratory experiment to determine which concentrations of Bismarck Brown Y solution ([1:15,000]; [1:30,000]; [1:60,000]) and fish exposure time (one and two hours) provided the most effective mark retention over a five-day experiment. Iowa Darter (*Etheostoma exile*) exposed to a dye solution for two hours displayed the most noticeable dye coloration after 96.75 elapsed hours indicating exposure time is more critical than dye concentration. A field experiment was conducted to evaluate the feasibility of this short-term biological marker in mark-recapture population estimates. Captured darters were dyed in a Bismarck Brown Y solution [1:15,000] for two-hours and then recaptured approximately 57 hours later. This field experiment displayed the benefit of Bismarck Brown Y to be safe to use on small fish species while allowing users to have a wide margin of error of dye solution concentration when mixing it in the field. Recommended use of Bismarck Brown Y as a marking method would include when managers need a short-term mass marking of sensitive species, accessibility to new equipment is restricted, and financial resources are limited. Use of Bismarck Brown Y would not be recommended to use if trying to track fish over time or when information about a specific fish is needed.

## **Characterizing Asialylated GM1 on T cells during acute virulent *Toxoplasma gondii* infection**

Ariel J. Gjovig and Jason P. Gigley  
Department of Molecular Biology  
University of Wyoming  
Oral Presentation

*Department of Microbiology*

*Gillette, WY*

*Toxoplasma gondii* (*T. gondii*) is an opportunistic protozoan parasite that infects 30 % of people worldwide. Infection with this parasite is a major health concern for immune compromised people and the developing fetus. There are no effective vaccines or therapies that can prevent or clear this infection. Therefore, understanding how immunity develops is critical for their rational design. Natural killer (NK) cells and T cells are essential for control of the parasite. The factors that are important for regulating the function of these immune cells during *T. gondii* infection are not completely clear. NK cells are known to have constitutive high concentrations of the asialylated form of the glycolipid GM1 (ASGM1) on their surface. ASGM1 may also be expressed on T cells but unlike NK cells can be upregulated in some infections suggesting that it is important for T cell function. Whether ASGM1 is expressed on T cells during acute virulent *T. gondii* infection is not known. To address this question, we quantified the change in ASGM1 expression on CD4 and CD8 T cells between naïve and infected mice. We used the highly virulent Type I parasite strain RH in our experiments. Understanding how ASGM1 expression changes on T cells during virulent *T. gondii* infection could lead to a better understanding of the factors required for optimal T cell function and better therapeutics to help the immune system to clear the parasite and terminate the infection.

## **Education Programs for Incarcerated People**

Michala Glover and Susan Dewey PhD  
Gender and Women's Studies  
University of Wyoming  
Poster Presentation

*McNair Scholars Program*

*Cheyenne, WY*

This study will investigate the effectiveness of prison education programs for incarcerated people in eight different correctional systems nationwide. I hypothesize that education programs can be effective in improving their knowledge, skills, and attitudes. Sources of data will be identified through different prison education programs across the nation to implement in Wyoming. The primary data will be examined through qualitative content analysis. This study will clearly identify successful prison education programs for incarcerated people to reduce recidivism and give them the knowledge, skills, and attitudes they need during and after their incarceration.

## **New Data from an Old Well: Changes in the Chemistry of Runoff Geothermal Well Water**

Aspen Golding and Nunzio Giorgio Carducci with Dr. Karen Wawrousek and Dr. Charles Nye

Chemical Engineering and Geology

University of Wyoming

Poster Presentation

*Chemical Engineering*

*Centennial, CO*

Water samples from human-made geothermal wells are challenging to collect. The water at the well head is often above its boiling point and pressurized. Because these traits make water sampling difficult, even low-temperature geothermal wells often are sampled after the water has cooled, decompressed, and interacted with some atmospheric air. Work with natural geothermal features has shown that waters rapidly re-equilibrate after reaching the surface (Lewicki, 2013). When geothermal well waters must be sampled far from a well head, has the damage already been done? The Center for Economic Geology Research at the University of Wyoming recently sampled from a recharge-pressurized low-temperature geothermal well in Wyoming's Great Divide Basin. The well has likely been flowing ever since it was abandoned shortly after completion in 1925. The age and disrepair of this well have resulted in a significant amount of bore scale and temperature equilibration in the ground near the well bore. A series of samples were taken starting inside the bore then at several points along the run-off stream until it terminates in an evaporate lake. These samples showed that some species equilibrate rapidly and as predicted, but that many other species remained consistent until the run-off stream terminated in an evaporate lake, at which point significant changes in almost every analyte occurred. This study shows that most analytes of interest to geothermal operations can be sampled further from the well head than previously thought, but only if evaporation is minimized. Our specific group took part in analyzing the presence of microorganisms to support the original hypothesis.

## **Measurements of Gender and Sexuality in National Surveys**

Carlos M. Gonzales with Dr. Jennifer Tabler

Sociology and Criminal Justice

University of Wyoming

Poster Presentation

*McNair, Honors*

*Buffalo, WY*

This research will investigate the measurements of gender and sexuality used in national surveys. We hope to show the use and understanding of sex, gender, and sexuality in these national surveys and how they differ across time and across different academic areas. The data will be collected using the codebooks and questionnaires from multiple national surveys. Information will be collected on how many questions are asked, what type of measurements are used, and other relevant information to collection of sex, gender identity, and sexuality. Analysis will be conducted by collecting information on individual surveys and then comparing across time and across fields. This information will contribute to understanding how scholars can make measurement more inclusive and informative, ensuring that all identities are properly accounted for. The information will also contribute to understanding the historical and patterned use of measurements by national surveys and how they have changed and remained static over time.

## **Exploration of Inquiry in Social Studies Education**

Daniel Good, Dr. Gabe Swarts

Education

University of Wyoming

Oral Presentation

*Honors*

*Denver, CO*

The educational world is rapidly changing and growing. The way that learning is accomplished has developed heavily in recent history. Students are rapidly becoming more accustomed with the necessary skills for the real world while learning them in the classroom. Educational research shows that students who learn through inquiry and through student-led exploration are able to retain more learning than students who are required to sit silently while taking notes in class. However, not all students have the opportunity to learn in this way. As a teacher it is important that your students learn in the most impactful way possible even when it is harder to prepare. Various schools around the state are currently working to grow in their use of inquiry which will in turn raise test scores, reading levels and student engagement. So much of this style of education ties in with literacy that this way of teaching encourages higher levels of reading and comprehension. This *Exploration of Inquiry in Social Studies Education* focuses on a high school World History classroom and on the use of inquiry based learning and teaching during a unit of study. Obviously, this is a small sample, yet it still provides insights to some of the positives and some of the growing pains experienced as schools begin to phase in Inquiry based learning. By peeling back all the bureaucracy it is possible to get a clear picture of where our education system lies and where it can improve.

## **Diet Comparison of the Great Horned Owl (*Bubo virginianus*) and Barn Owl (*Tyto alba*) in Cimarron County, Oklahoma**

Viviana I. Hinojosa, Mary E. Graham, Dr. Courtney L. Springer,

Dr. Ami L. Wangeline, Dr. Zachary P. Roehrs

Department of Natural Science

Laramie County Community College

Poster Presentation

*Department of Natural Science, INBRE*

*Cheyenne, WY*

*Austin, TX*

Ecological theory suggests that two species cannot occupy all dimensions of the exact same niche. As part of previous research into barn owls (*Tyto alba*,  $n > 1500$ ) and great horned owls (*Bubo virginianus*,  $n < 65$ ) in Cimarron County, Oklahoma, this study analyzed skeletal remains found in owl pellets to understand the extent of niche overlap between these two species with respect to diet. The results of this study suggest that prey species diversity is relatively similar for great horned and barn owls. Additionally, our data suggests that prey species richness is higher for barn owls than for great horned owls, which may reflect pressures to decrease niche overlap. However, previous studies have shown larger predator species prey on a greater range of food sizes indicating our findings may be a reflection of sample size bias or incomplete representation of species in great horned owl pellets. Finally, we found that great horned owls typically preyed on species that had a greater body mass than those caught by barn owls. This prey size difference may reflect pressures to decrease niche overlap, which aligns with results from other studies. Overall, the results of this study indicate that, while these species share a similar niche in terms of species diversity in their diets, they have dissimilarity in preferred prey size, potentially demonstrating a mechanism that allows them to coexist.

## **Food Insecurity Among Students at the University of Wyoming**

Katherine Greenwell with Dr. Gabel Taggart, Arts & Sciences

University of Wyoming

Poster Presentation

*McNair Scholars Program*

*Cheyenne, WY*

This study will examine food insecurity among students at the University of Wyoming. The objectives of this study are to conduct a needs assessment for services targeted at students experiencing food insecurity, and to analyze alternatives for improving these services. We will use a mix methods approach that will include a random sample survey of students, interviews with nonprofit administrators, analysis of original documents from selected programs at other universities in the region. Food insecurity has the potential to negatively affect student success, wellness, retention, and academic performance.

## **Copying Human Consciousness to Machines on a Worldwide Scale is Needed Because the Benefits Outweigh the Risks**

Sky Gritten with Adrian H. Molina

University of Wyoming

Oral Presentation

*Honors*

*Cody, WY*

To copy human consciousness means to replicate someone's senses, memories, their ability to reason, make decisions, to imagine new possibilities, their emotions, and process new information. Human consciousness may be stored in a hard drive device or on a glass disc that is accessed through a cloud service or internal based storage machine. Striving to understand the mechanisms of human consciousness so that it can be preserved...is one of the most important scientific advances needed for humanity as a whole. To preserve human consciousness for future generations is, in itself, a form of immortality, and could allow brilliant minds to continue creating positive change long after they are dead. Since technology makes exponential positive advancement every year, we need to consider the future of human progress as a starting point. This paper explores the ethical concerns of copying consciousness with hypothetical situations. Additionally, this paper points out the potential negative consequences of allowing global access to consciousness replication. In conclusion, this paper shows how the potential benefits outweigh the concerns for copying consciousness.

## **Metabarcoding *Ovis aries* Nasal Samples**

Drew Groll and Eric C. Atkinson  
*Northwest College, Biology Department*  
*Poster*

*INBRE*

*Evanston, WY*

Bighorn sheep (*Ovis canadensis*) populations in the West are often limited by diseases, including microbial pathogens that may be carried asymptotically by domestic sheep (*Ovis aries*). With the right conditions, certain microbial pathogens can be a causative agent of pneumonia in bighorn sheep which is often fatal. We were interested in looking at not only those pathogens, but the entire microbiome found in the respiratory system of domestic sheep. Nasal samples were aseptically collected from two ewes, and eight lambs of domestic sheep within twenty-four hours of their death. These samples were collected from a herd of domestic sheep in the Big Horn Basin. Using Bioinformatics theory and application, we extracted DNA, amplified 16S ribosomal DNA (V4 region) following Earth Microbiome Project protocols and sequenced on Illumina platform. Metabarcoding data were characterized via the QIIME2 pipeline to see what types of bacteria were present in the domestic sheep at their time of death.

## **The Interdisciplinary Climate Change Expedition (ICCE)**

### **Emerging From Primary Succession: Microbial Activity in Dinwoody Cirque Soils**

Lena Grover, Bailey Lewis, Elizabeth Traver PhD Candidate University of Wyoming  
Alpine Science Institute  
Central Wyoming College

*INBRE, EPSCoR, NASA*

*Lander, WY*

Alpine ice masses around the globe are undergoing rapid melt. As glacial ice recedes, soils that have been ice-covered for hundreds to thousands of years are exposed. These soils emerging from primary succession may contain microbial communities that have gone unobserved to date. In August 2018, students from the CWC Interdisciplinary Climate Change Expedition (ICCE) conducted soil sampling in the Dinwoody Cirque of Wyoming's Wind River Range. The study area was divided into five different transects, ranging from most recently exposed soil at the terminus of the glacier, to older developed soils near the terminal moraine from the Little Ice Age (~1850). Cover class was assessed at each sample site, and a one-ounce sample of soil was collected along with a sample for DNA testing. In the lab, one soil sample from each transect was diluted to examine bacterial growth. Unique growths were subcultured and outsourced for Sanger sequencing to determine the microbes living in the soil. Bacterial growth was analyzed and revealed patterns of microbial activity in the soil that overlap with communities with similar topography, as well as communities that have vastly different environments. Results remain inconclusive at this time. The ICCE team will continue to test soils in the Dinwoody Cirque to assess further microbial activity.

## **Reptile Residents of Chumbe**

Ananna Gudmunson  
University of Wyoming

### *Honors*

Chumbe Island Coral Park (CHICOP) in Zanzibar, Tanzania is a remote island with a dense coral rag forest primarily untouched by humans and no permanent residence. This was the first scientific terrestrial reptile study conducted on the island. The survey started on April 9, 2017 and concluded on May 3, 2017 during a study abroad semester with the School for International Training (SIT). A variety of methods were used to survey the different microhabitats on the island. Line transects surveyed the forest walking paths and intertidal zones. Active searches were used in the compost heap. Refuge traps made of tin were placed in various locations. These heated up under the sun, providing great basking places. This study confirmed most of the known species recorded from informal observations, identified two new species (*Hemidactylus mabouia* and *Lygodactylus luteopicturatus*), and generated base line information about the reptile population densities. The results of this study updated the reptile species list for CHICOP, which may bolster support for future funds that will further the understanding of the flora and fauna.

## **Extraction and Isolation of Medicinal Proteoglycans from Pearl and Blue Oyster Mushrooms**

Thomas Haack and Madalyn Montgomery with Dr. Eric Mechalke  
Chemistry  
Casper College  
Poster Presentation

### *INBRE*

*Casper, WY*

Many common edible mushrooms have been documented to display medicinal properties. Proteoglycans found in oyster mushrooms were correlated with anti-tumor and immunomodulatory responses with Sarcoma-180 cancer cells. The purpose of this study is to isolate the best growth and extraction method to maximize the amount of proteoglycans separated from mycelia and sporocarp. Pearl and blue oyster mushrooms were grown in different environments in order to determine the maximum growth of mycelia for each mushroom. Proteoglycans will be extracted from the maximum growth to find the greatest percent yield from each mycelia and sporocarp.

## **Improving HVAC Performance for Legacy Molding**

Alan Halverson with Dr. Kevin Kilty  
Mechanical Engineering  
University of Wyoming  
Oral Presentation

*Engineering*

*Laramie, WY*

This Senior Design Project utilizes computer generated models to improve HVAC systems in challenging environments, namely Legacy Molding's headquarters. Plastic and fiberglass molding machines generate high heat loads requiring substantial HVAC systems to produce comfortable work station temperatures. Smaller molding businesses, like Legacy Molding located in Riverton, Wyoming, are commonly housed in relatively small buildings not designed for extreme heat loads, further complicating a possible HVAC solution. By integrating experimental data into a three-dimensional thermodynamic computer model, this report can conclude that Legacy's current HVAC system (or other similar systems) can be improved by repositioning ductwork and molding machinery. However, completely replacing elements of the system is ultimately recommended to ensure reliability and longevity.

## **Wyoming Rabies Control**

Neta Hansen and Joslyn Cassady  
Honors College  
University of Wyoming  
Oral Presentation

*Honors*

*Cody, WY*

Rabies is a viral disease affecting more than 60,000 people in the United States of America (USA) annually. In the instance where the victim does not receive postexposure prophylaxis (PEP) before the onset of symptoms rabies, it is nearly universally fatal in humans (WHO, 2018). This viral disease is commonly spread through the saliva of infected animals during a bite to another organism (Signs, 2011). Statewide surveillance of animal bites, both domestic and wild, is necessary to reduce rabies transmission. This study was conducted to assist the Wyoming Health Department (WHD) with rabies intervention efforts by entering animal bite report data from 2016 and analyzing trends. The results show that the majority of reported bite cases are from domestic vaccinated animals and roughly 60% of all reported cases involve an adult being the victim. Although there is the possibility for civilian reporting the majority of the reports are from animal control or healthcare providers. This could account for the bias in the severity of the bites that are reported. Of all the cases the WHD received roughly 70% are not receiving PEP due to the low risk factors. Preventative measures and statewide surveillance have been instrumental in advancing the ongoing efforts of WHD with rabies interventions in Wyoming.

## **Analyzing Lichen Growth on Cacti Relative to Fog-Zone Proximity in the Atacama Desert**

Grace Hartman with Dr. David G. Williams

Department of Botany

University of Wyoming

Poster

*WRSP*

*Laramie, WY*

Fog deserts produce distinct environmental conditions that allow the survival of endemic species, rare habitats, and biodiversity not commonly sustained in exceedingly arid ecosystems. Increased fog drip contributes to increased vegetation quality and quantity, but the extent to which fog influences the desert is still questioned. This study researched the relationship of lichen growth on large cacti in the Atacama Desert, Chile, relative to the cacti's fog-zone proximity. Two cactus-spine sequences were collected from the fog zone (sample A) and outside the fog zone (sample C) for  $\delta^{18}\text{O}$  analysis. The spatial separation of sample A and C allows us to observe potential differences in  $\delta^{18}\text{O}$  values depending on the samples' primary water source. Since fog has more positive  $\delta^{18}\text{O}$  values than rainfall values, we expected a similar correlation between our sample A and C results. However, our isotopic analysis showed reversed results; sample A's average is 35.7‰ and sample C's average is 36.6‰. This observation suggests that further research is needed beyond just studying the fog influence on lichen growth. More consideration into the physiological and competitive relationship between cactus and lichen can also help us broaden our understanding on fog-drip impact. The Atacama is representative of other fog deserts reliant on climate patterns for its habitat viability. It is important to understand fog's ecological impact to understand the implications of variable fog availability in the future.

## **Central Wyoming College Interdisciplinary Climate Change Expedition (ICCE):**

### **Black Carbon Analysis in the Alpine of the Dinwoody Cirque**

Grace Hartman with Professor Jacki Klancher and Dr. Carl Schmitt

Alpine Science Institute

Central Wyoming College

Poster and Oral Presentation

*EPSCoR, INBRE, and NASA*

*Lander, WY*

Alpine glaciers in Wyoming's Wind River Range are experiencing changes in regional climatic patterns and subsequent loss of ice mass. Glacial recession stresses local and regional water resources, as glacial ice reservoirs help regulate and stabilize seasonal flow. The work presented here builds on four years of previous efforts and discusses the impacts of black carbon deposition on the permanent snowfields and surface snow from the Dinwoody Glacier and periglacial environs. Black carbon, whether produced through natural sources like forest fires, or via anthropogenic roots (incomplete fossil fuel combustion), is a powerful light absorbing particulate and can drastically reduce surface albedo. Decreased albedo, in turn, increases infrared absorption and accelerates snow and ice melt rates. In August 2018, 32 black carbon samples were collected from the Dinwoody Cirque. All samples were analyzed using the Light Absorbing Heat Method (LAHM) in conjunction with Dr. Carl Schmitt from the National Center Atmospheric Research. Black carbon samples were assessed for total effective black carbon (eBC) in nanograms per gram of water (ng/g). The mean for samples from 2018 was 56.06 eBC ng/g. This average is higher than values from 2017 (52.27 eBC ng/g) and 2015 (30.0 eBC ng/g), but lower than values from 2016 (193 eBC ng/g). The extent of black carbon impact in high-alpine regions is still uncertain. Nonetheless, continuous monitoring in the Dinwoody Cirque is critical to understand the glaciologic and hydrologic changes that will impact the future.

### **Small Footprint Smart Greenhouse**

Austin Harwood and Elijah Theander with Dr. Steve Barrett  
Electrical and Computer Engineering  
University of Wyoming  
Oral Presentation

*Electrical and Computer Engineering*

*Laramie, WY*

In locations that have high temperatures, or for housing areas that do not have much space, it can be difficult to grow fruit and vegetables. Additionally, having to remember to water the plants and maintain a full greenhouse could be a difficult task for a person that is very busy. The goal of this project was to create a proof of concept for a small greenhouse that is automated. This greenhouse has an electrical control system that keeps track of temperature and humidity, controls fans, vents, and water valves, and provides a user set watering schedule to take the hassle out of maintaining a greenhouse. This greenhouse is electrically self-sustaining, by having all of its power needs being supplied by a solar panel and a battery. The only external source a user of the greenhouse would need to supply is a connection to a water valve.

### **Vehicle Occupancy Detection System**

Dalton Hass, Kyler Lunberg, Braxton Cooper with Dr. Cameron Wright  
Electrical and Computer Engineering  
University of Wyoming  
Poster Presentation

*Cheyenne, WY*

The Vehicle Occupancy Detection System (VODS) is a product that could potentially help save up to 40 lives a year. The idea of the VODS is to implement an inexpensive device that can be easily placed into any car and will be able to detect if there is any life source in the car. Once it has detected whether there is a life source in the car, it will then check the temperature of the vehicle. If both the temperature of the vehicle has reached and dangerous temperature and there is a life source in the car, an alert will be sent to the owner of the car making them aware of this harm. If the owner does not respond within a specified amount of time that is dependent on the heat of the vehicle then, the system will send an emergency signal to prevent a possible death. We plan to make this happen by using a raspberry pi zero microcontroller to control and power the motion sensor, vibration sensor, temperature/humidity sensor and of course the 3G sim card to allow messages to be sent for communication. The motion sensor and temperature/humidity sensor will oversee detecting whether there is a life source within the vehicle. The vibration sensor will be used to determine whether the car is on. There will be an app on your phone which you can install to oversee what is going on within your vehicle.

### **Motorized Puzzle Interface**

Allyson Hays with Suresh Muknahallipatna  
Electrical and Computer Engineering  
University of Wyoming  
Oral and Poster Presentation

*Aurora, CO*

Puzzlebot is a motorized robotic puzzle interface, which picks up, moves, and rotates pieces based on user inputted commands. It is a motorized XYZ table that uses magnets to pick up puzzle pieces and move them between predefined coordinates. It can be used as a mobility aid for those with limited or no use of their hands for various medical reasons. This design is low cost and relatively simple and can thus be modified or used as a basis for other uses. For example, the input method used for this prototype is a keypad, but given that the input is simple text, other input methods, such as speech to text devices, could also be compatible with the design.

### **Film Washout**

Mark Hazelett, Garrick Tolman, and Myranda Weakland  
University of Wyoming,  
Mechanical Engineering Department

Automating the washing and drying process for ultraviolet (UV) sensitive rubber in a pressurized closed system has challenging aspects. UV sensitive rubber is used for transferring designs into glass, rock, and other hard surfaces during sand etching. The washout machines currently on the market require a large space, direct connection to water plumbing, and only perform the washing process. The goals of this project are to combine the washing and drying processes, limit human-machine interaction time, reduce water usage, minimize the working footprint, and eliminate the need for direct connection to water plumbing. This was accomplished by using a closed system and turbidity meter to maximize the usefulness of the water. Improving the usability of the washout unit was done by automating the washing and drying process and decreasing overall size. The combination of the small size with the closed water system allows for versatility in shop placement and operation in locations of limited plumbing access. Overcoming the challenges associated with the combination of the washing and drying processes in pressurized closed system improves the versatility and usability of the washing and drying of UV sensitive rubber. This washout unit is being prototyped and our sponsor plans to use it in their engraving business.

## **Dyckhoff Theorem Prover**

James Heaney  
University of Wyoming

*Honors, CS*

As computing becomes an integral component of our society, it is becoming increasingly important for students to understand how computers work and the areas of mathematical study that support their applications. One such area of study is Automated Theorem Proving (ATP). By studying ATP, students learn about the practical uses for formal language theory, develop their reasoning skills, and further their understanding of the foundations of modern mathematics. To allow students to develop these skills, the *Dyckhoff Theorem Prover Project* provides a set of open source ATP solutions and documentation that are accessible to undergraduates. An easy-to-use Graphical User Interface (GUI) is also included. The theoretical foundation for a large part of our work is provided in a seminal paper by Donald Knuth and Peter Bendix from the ATP literature. By implementing the theory described, we've provided a direct means for computer science and mathematics students to experiment with universal algebras and confluent term-rewriting systems that derive new theorems from a given set of axioms. As our code is open source and written in the expressive, functional Haskell programming language, our work may also serve as a practical guide to understanding and appreciating the theoretical work of Knuth and Bendix as well as the wider ATP literature.

## **Marketing Manhattan: Tourism in New York After the September 11 Attacks**

Katelyn Hekkert with Dr. Kent Drummond  
Management and Marketing  
University of Wyoming  
Oral Presentation

*Management and Marketing*

*Highlands Ranch, CO*

September 11, 2001 was one of the most tragic days in United States history. Nineteen men hijacked four US commercial airplanes, crashing into the World Trade Center, the Pentagon, and a small town in Pennsylvania. At the World Trade in New York City, 2,753 people were killed and thousands more were injured (CNN, 2001). By the end of the year, the direct impact to the tourism industry was estimated to be 2.3 trillion dollars (United Nations World Tourism Organization, 2017). The attack caused widespread panic and fear of traveling throughout the country and the world. Airlines, hotels, tourist attractions, and the city of New York had to regain trust in travelers and rebuild their image as one of the most popular tourist destinations in the world. The goal of this project is to analyze the marketing strategies and best practices of the tourism industry in New York City after the devastating attacks of September 11. The scope will include the financial, psychological, and social impact of the attack on tourism companies, hotels, and tourist attractions in New York City and the strategies used to overcome the damage. The results will likely suggest that innovative, comprehensive marketing strategies were effectively executed to encourage trust in the tourism industry and rebuild the reputation of New York City as a premier tourist destination.

## **The Association between Obesity and ADHD in College Students**

Zoe Hendricks with Dr. Cynthia Hartung

Psychology

University of Wyoming

Oral and Poster Presentation

*INBRE*

*Colorado Springs, CO*

With a lifetime prevalence for U.S. adults aged 18 to 44 years old of 8.1%, attention-deficit/hyperactivity disorder (ADHD) is a brain disorder consisting of an ongoing pattern of inattention, hyperactivity, and/or impulsivity (NIH, 2017). Commonly known to hinder brain functioning and development, recent evidence suggests that people with ADHD demonstrate less healthy characteristics than people without ADHD (Nigg, 2013). These findings are significant to the medical field because doctors need to educate patients with ADHD about the increased risk of adverse health outcomes and potentially provide treatment for diabetes, obesity, and/or hypertension, which may contribute to the shorter life expectancy of people with ADHD (Barkley & Fischer, 2018). The current project analyzed the association between ADHD and obesity in college students through the comparison of Body Mass Index (BMI), Fat Mass Index (FMI), and Percent Body Fat (PBF). Symptoms of obesity (e.g., deficits in alertness) can manifest as ADHD-like features; ADHD and obesity share common genetics and neurobiological dysfunctions; and impulsivity and inattention of ADHD contribute to weight gain via dysregulated eating patterns (Cortese & Vincenzi, 2011). The results indicate that college students between 18- to 25-years-old with ADHD have slightly higher BMI, FMI, and PBF than their non-ADHD peers. However, these findings cannot be confirmed with statistical significance, potentially due to small sample size. This study has contributed new evidence to the field of ADHD research through the comparison of BMI, FMI, and PBF in college students.

## **Altitudinal variation in flight morphology and kinematics of common-garden reared bumblebees (*Bombus vosnesenskii*)**

Zach Parsons, JD Herndon, JP Strange, JD Lozier and Michael E. Dillon

University of Wyoming

Altitudinal shifts present a potential means of tracking optimal temperatures over short geographic distances in response to warming climates. Although upslope shifts may allow organisms to escape rising temperatures, decreased air density at higher elevations increases aerodynamic and energetic costs of flight, potentially restricting upslope shifts for flying organisms. However, fliers could compensate for low air density through changes in morphology and kinematics. Bumblebees collected from high elevations have relatively larger wings than those from low elevations, likely to facilitate flight in thinner air. But whether such morphological changes result from developmental plasticity or adaptation is unknown. We caught queen *Bombus vosnesenskii* from low (70 m asl) and high (1475 m asl) elevation sites in Oregon, USA. We reared colonies from these queens in common-garden conditions in the laboratory and then subsequently measured flight morphology and kinematics in high elevation (2100 m) conditions. We will discuss how morphology (body mass, wing area, and wing moments) differ between common-garden reared and field-collected bumblebees and how differences in morphology alter flight kinematics during hovering flight.

## **Granite Construction Hoist System**

Darby Herne, Mackenzie Hewitt, & Alex Powers with Dr. Kevin Kilty  
Mechanical Engineering  
University of Wyoming  
Oral

### *Department of Mechanical Engineering*

Granite Construction requests a permanently mounted hoist system on top of the asphalt silos for their Smith Island Hot Plant in Everett, Washington. There are four requirements for the hoist: 66 feet of vertical lift, a hoist capacity of 500-1,500 pounds, no operator license requirement, and a \$20,000 budget. This hoist will eliminate the need for Granite to use a third-party crane rental for routine maintenance and parts replacement. The hoist will also decrease plant downtime, save money, and increase the safety of employees who currently carry what parts they can to the points of maintenance. There are two hoist designs presented for Granite's consideration. One implements a Gorbel Floor Mounted Jib Crane rated for 1,500 pounds. According to OSHA, this crane does not require an operator license. The second and less expensive system utilizes a winch and is capable of hoisting 500 pounds. Both designs require a custom mounting platform to be built that will not damage the existing structure and support the hoist and maximum load.

## **Drug Resistant Bacteria Prevalence in Conventional vs. Organic Agriculture Compost Almagamated with Soil**

Tawna R. Herrera and Elise J. Kimble  
Biology Department – Northwest College  
Poster

### *INBRE*

Humans use compost for agriculture, horticulture, and soil sciences. Are all compost created equal? Environmental bacteria in conventional compost are exposed to antibiotics that could select for increased resistance to antibiotic treatments. To test this hypothesis, we took samples of compost mixed with soil from five farms located in Park County, Wyoming and Carbon County, Montana; three organic and two conventional. Compost samples are initially spread on TSA agar medium plates followed by isolation of bacteria. With complete isolation of bacteria, a suite of antibiotic discs is then placed on lawns of bacteria using the Kirby-Bauer method. Preliminary results of organic compost have yielded fifteen disparate drug resistant bacterial types out of 50 isolates. Conventional compost bacteria isolates however, had fourteen drug resistant bacterium out of 44 isolates thus far. Tentative identification of the drug resistant bacteria will provide an indication whether agricultural practices lead to greater exposure to pathogenic drug resistant bacteria.

**Adjusting for depression: How the presence and severity of depressive symptomatology affects expected utility regarding normative decision-making about social situations**

Brian A. Hinman and Ben Wilkowski

Psychology

University of Wyoming

*McNair Scholars*

*Laramie, WY*

Many variables factor into how one might make and execute a decision, including one's mental health. Evaluation-choice routine decision-making, a specific Decision Theoretic decision-making process, states that an individual should act on the decision that best maximizes their expected utility (that being their utility [money, preference, etc.] weighted for the probability of such being obtained). However, to the knowledge of the researcher, it is not known the exact affects the presence and severity of depressive symptomatology has on an individual's expected utility in decision-making. This study aims to find whether the presence and severity of depressive symptomatology has an effect on an individual's expected utility in decision-making. To do so, participants will complete a survey measuring depression, what they believe the probability of specific environmental factors occurring when making, independently, two decisions (providing help and asking for help respectively), and preference for engaging in decisions given a combination of environmental factors (decisional situations). Afterwards, the researcher will use multiple linear regression with inclusion of indicator variable(s) to determine the effect. Given the literature tangential to this research, the researcher hypothesizes that if an individual has elevated levels of depressive symptomatology, then their expected utility for each decision will differ significantly from those with less elevated/no depressive symptomatology.

**College Student Perceptions on Parental Involvement: A Qualitative Study Examining the Transition to College Life**

Jessica T. Hinojosa, Dr. Cynthia M. Hartung, Department of Psychology

University of Wyoming

Oral and Poster Presentation

*Department of Psychology*

*Chicago, IL*

Upon entering adulthood, college students may desire a balance between parent involvement and independence. Previous research proposes theories (e.g., attachment theory, self-determination theory, and emerging adulthood developmental stage) that may explain observations across these communication patterns and parent involvement (Lapsley & Edgerton, 2002; Deci & Ryan, 2008; Arnett, 2004). The current study examines communication patterns between freshmen and sophomore undergraduates and their parents to interpret how the adjustment impacts their development as emerging adults. Participants completed a demographics questionnaire followed by an open-ended, audio-recorded interview highlighting parental involvement, parental support, and communication. Major themes included communication content and frequency differences between mother and father figures, level of parent involvement, using parents as an emotional safety net, differences between what kinds of support is perceived and what level is ideal, and communication impacts. Participants expressed satisfaction with their parental involvement while simultaneously viewing their own family relationships more positively than the relationships their peers have with their families. Results suggest that transitioning from high school to college warrants a renegotiation of the parent-child relationship. Findings support emerging adulthood as a developmental stage and follow a model identical to the similarity-fit hypothesis (e.g. similar parent-child experiences enhance relationships due to mutual sharing of experiences related to college or adult transitions) (Johnston et al., 2016). Details about findings and future directions will be included in the presentations.

## **“Words: How We Enter the World”: A Creative Writing Reading**

Larissa Hipp with Prof. Diane Panozzo  
English/Creative Writing  
University of Wyoming  
Oral Presentation

*Honors*

*North Platte, NE*

“Words: How We Enter the World” is a creative work in which place plays an integral role. This compilation of poetry and short essays contains first-hand experiences the author has had while travelling, living, studying, and working outside of the United States. This creative work aims to express the significance of travel in understanding and constructing our world while also accurately expressing a sense of place for readers and listeners who have and have not visited the sites referenced. Language is how we build and name the world around us, however, in order for us to truly understand that process and fully participate in the global community, we have to immerse ourselves in it. This creative work will illustrate the effects and experiences of these considerable, immersive times and places.

## **Comparing Spatial Training in Augmented Reality and the Real World**

Kalani Hoenisch with Dr. Meredith Minear and Tes Sensibaugh  
Psychology Department  
University of Wyoming  
Poster Presentation

*McNair Scholars*

*Roseville, CA*

This study will compare the efficacy of training spatial skills using an augmented reality (AR) device to the use of real-world 3D-printed objects. Our research question is whether there is an advantage to interacting with a physical object over AR when training mental rotation. In addition, we will test whether individual differences in spatial skill, strategy, or working memory interact with training. We hypothesize that while both mental rotation training regimes will improve performance, training with real world objects will be superior. Collected samples are college students recruited from the University of Wyoming. Measures used during this study include the Purdue Spatial Visualization Test: Revised version (PSVT:R) for assessing mental rotation performance, 3D-printed Purdue objects from PSVT:R for physical training, Meta2 Augmented Reality headset, a Gazepoint 60Hz eye-tracker for assessing mental rotation strategies, and computerized measures of working memory capacity. The importance of this study is to assess the potential of using augmented reality in training spatial ability.

**Neighborhood effects on the frugivory rate of the Hawaiian native plant, *Dianella sandwicensis*, in a novel ecosystem**

Rosemary Hopson with Dr. Corey Tarwater and Rebecca Wilcox  
Zoology and Physiology  
University of Wyoming  
Oral

*WRSP, NASA Space Grant, Honors*

*Gillette, WY*

Seed dispersal is a critical process responsible for maintaining plant communities and ecosystem function. For plants that require animals to disperse their seeds, the probability of visitation and fruit consumption by dispersers may be influenced by traits of the focal plant and the local neighborhood. Invasive dispersers and plants may further complicate relationships, potentially altering what traits influence frugivory. Here we examined the influence of focal plant and neighborhood characteristics on visitation and frugivory by invasive dispersers on a native plant, *Dianella sandwicensis*, on Oahu, Hawaii, where no native vertebrate dispersers remain. We placed cameras on our focal plant to assess the effects of number of ripe fruits on the focal plant, the amount of ripe fruit in the neighborhood, the percent of exotic fruit in the neighborhood, and concealment around the focal plant on visitation and fruit removal rate. We also examined whether these relationships differed depending upon disperser type (ground bird vs songbird). Our results showed that these traits had no effect on visitation, fruit removal rate, or the probability of visitation by a songbird; however, concealment influenced the probability that a ground bird visited. Plants that were more exposed had a higher probability of being visited by ground birds. Ground birds act primarily as seed predators, thus increasing concealment around native plants could help preserve these species. More generally, this study suggests that it is important to consider how neighborhood effects influence different types of dispersers, furthering our ability to manage native plants in degraded ecosystems.

**Pathways from Prison: Parenting Programs and Sex-Offender Policies**

Riley Realing, Ariel Horn, and McKenna Lipson with Dr. Dewey  
International Studies, Social Work, and Psychology  
University of Wyoming  
Oral Presentation

*Gender & Women's Studies and Honors*

The goal of this project is to present findings on two underrepresented subpopulations of inmates: parents and sex offenders. We studied the benefits and obstacles of implementing parenting programs in prison for incarcerated mothers and fathers. We reviewed texts that studied the well-being of children with incarcerated parents and suggested several approaches these incarcerated parents could use to improve their relationship with their child(ren). From there, we visited Wyoming prisons to experience the prison environment first-hand and share our research with the prisoners and faculty. After discussing our findings in prison, the final product of this study is a guidebook created for prison faculty summarizing how to establish an effective parenting program and its benefits. Additionally, we examined resources and barriers that exist for the reintegration of sex offenders into larger society. We engaged in an explorative, qualitative analysis of existing literature. Subsequently, we compiled a thorough annotated bibliography and report of the findings. This information will ultimately be presented to the Department of Corrections. Parenting programs and sex-offender policies are marginalized components of an already forgotten population. The importance of these studies demonstrates the need for specific evidence-based prison programs and policies in order to reduce recidivism and strengthen communities.

## **Neuronal Mechanisms of Decision Making: Investigating the Neural Connections between Sensory and Motor Brain Areas**

Holly Huber, Emily Person and Kristina Zaharas with Jonathan Prather

Department of Zoology and Physiology

University of Wyoming

Oral and Poster Presentation

*INBRE*

*Green River, WY, Rapid City, SD, Cheyenne, WY*

A decision comprises two parts: sensory input allowing us to perceive environmental information, and motor output allowing us to respond to experienced sensation. Because the technology required to sample spatially and temporally precise activity at the cellular level is not yet available in humans, we turn to an animal model. To identify the role of auditory cortical areas (Caudal Mesopallium, CM and Caudal Nidopallium, NC) in Bengalese finch decision making, lesion and trace studies can be used to map out the projections from these established areas to downstream targets. Ibotenic acid was used to create small focal lesions in CM or NC (separate studies) of each hemisphere in each female songbird's brain. Behavioral tests were conducted to measure mate preference before and after lesioning. After determining the importance of these regions in mate choice, Biotinylated Dextran Amine (BDA, 10 KDa MW) was injected directly into CM and NC (separate surgeries) and the trace dye was allowed fully extend through the pathways. The tissues were collected, processed, and imaged. After confirming the lesioning of CM and NC alters female mate choice,<sup>1</sup> pathway studies revealed that CM projects to motor cortical areas (robust nucleus of acropallium, RA), sensory cortical areas in forebrain (NC and ventral portion of intermediate acropallium, AIV), and the basal ganglia (caudal striatum, CSt). NC also projects to AIV, suggesting NC and AIV may play a role in this important decision-making process.

## **Using LPA to analyze parenting styles in Chinese cultures**

Jackson Hult

University of Wyoming

Latent Profile Analysis (LPA) provides a variety of different approaches to determine the best possible model of number different groups within a population. LPA has been used in similar studies (Kim 2013 and Wu 2002), which motivate its use in this study. By using statistical software, we analyze data for how many groups possibly exist in the population and the variety within them. When looking at the reasons for the differences, we use nine different indicators scaled into z-scores of parenting styles administered via survey to Chinese mothers and fathers. We analyzed the differences in parenting style of mothers, fathers, and both at the same time. We determined that there are two types of parents when looking at only mothers, two types of parents for only fathers, and three groups when looking at both. The different groups all have characteristics that can be explained based off of the answers to the questions. Responses to questions on coercion, shame, and modesty explained differences between groups of fathers and groups of mothers. Responses to questions based on mother coercion, father modesty and mother modesty explained the differences between groups of mothers and fathers together. Our work could help parents by telling them what aspects of parenting they need to improve. The results could be connected with performance of the children in a school setting and we could reveal the best styles that produce better students on average.

## **Tectal activity underlying phototactic preferences in the *Xenopus laevis* tadpole**

Jasper E. Hunt with Kara G. Pratt, Ph.D.

Neuroscience

University of Wyoming

Oral and Poster Presentation

*INBRE*

*Laramie, WY*

The *Xenopus laevis* tadpole has long been known to exhibit phototactic preferences, i.e. preferences to swim towards or away from visual stimuli. Of particular interest is the tendency for stage 48 *Xenopus* tadpoles to prefer green light but for older tadpoles to prefer blue light (Jaeger & Hailman, 1976). Recent work has begun to characterize the timeline of development for *Xenopus* rod and cone cells with different light specificities (Parker et al., 2010), relating this developmental timeline to the shift in color-guided phototactic preferences. Yet still little is known about the neural processing of color in the developing brain. The first experiment of the present study extends previous behavioral data, demonstrating that even outside of forced-choice paradigms (e.g. that used in Jaeger & Hailman, 1976), stage 48 *Xenopus* tadpoles spend more time in green light environments. To further investigate the neural mechanisms underlying color processing in the developing brain, a second experiment used *in vivo* electrophysiology methods to examine neural activity in the optic tectum – the visual processing center of the *Xenopus* brain – during the processing of color. To the authors' knowledge, this is the first study comparing tectal activity in response to different colors of light. The results of these experiments hold promise to shed light on both the neural processing of color in development and its relation to behavior in the developing tadpole.

## **The Effect of High Salinity Irrigation on *Cucumis sativus* Physiology and the Rhizosphere Microbiome**

Cheyenne Hunter, Alexis Pierce, Owen Sutton, Yanique Linton, Holli McAdams

with Ami Erickson and Nic Blouin\*

Natural Sciences

Sheridan College

University of Wyoming\*

*Oral Presentation*

*INBRE*

*Sheridan, WY*

Available agricultural water is becoming more saline in some areas. Increased salinity affects plants, but we do not know how salinity affects the microbiome of those plants. We hypothesize that plants watered with saline water will not grow as well as the ones watered with low-saline water, and salinity will change the microbiome diversity. Seeds of cucumber plants (*Cucumis sativus* var. Sweet Burpless) were planted in a field with a drip irrigation system over a 9-week period. Starting at the seed stage, two rows of cucumbers were watered with well water which was higher in NaCl (1638 $\mu$ S) and two rows were watered with city water which were lower in NaCl (154.5 $\mu$ S). Physiological response to treatment was evaluated on leaf water potential, photosynthetic rate (A), stomatal conductivity (gsw), and yield. The impact of the treatments on soil was evaluated with weekly measurements of salt conductivity from soil samples and pH of the soil. DNA samples were collected 6 times during the experiment. Dry biomass of shoots were taken after the experiment. Plants in the higher salt treatment showed no statistical difference in physiological responses. DNA was isolated using the DNeasy PowerLyzer PowerSoil Kit. PCR of the DNA was conducted using V4 hypervariable region of the 16S gene and then ITS for fungi primers. DNA will be sequenced on an Illumina MiSeq 2 x 250 bp by GeneWiz. We will use Qime 2 to analyze the sequence results. Based on our preliminary data, our hypothesis is not concluded.

## **Exploring the Chemical Composition of *Cucumis sativus* and *Cucurbita pepo* Roots**

Holli McAdams, Cheyenne Hunter with Ami Erickson and Rob Milne

Natural Sciences

Sheridan College

*Poster Presentation*

INBRE

*Big Piney, and Hannah WY*

Mucilage is a slimy substance containing plant-specific polysaccharides and lipids and can be extracted from the root of a plant. It is a very important part of the rhizosphere that can contribute to many fundamental plant-to-soil interactions, such as root penetration, soil aggregate formation, microbial dynamics and nutrient turnover (McCully, 1999). Lipids are typically hydrophobic, some more than others, which can influence water uptake. In this study we examined *Cucumis sativus* (cucumber) and *Cucurbita pepo* (zucchini) roots by investigating their lipid composition. The two plant species are closely related, therefore we could assume their lipid composition would be similar. Seeds were germinated in wet paper towels and allowed to grow for three weeks. After germination, roots underwent a multi-step soaking process. They were soaked in water for five hours and then boiled for two. They were then soaked for another two hours in a 1:1 volume of ethanol to water. Following this, root extracts were dried to transesterify extracted lipids. Extracts were evaluated using gas chromatography-mass spectrometry. Results will be presented.

## **DFT+U Simulations of Uranium Mononitride: Modelling Potential Nuclear Fuels**

Bryant B. Jerome with Dr. Dilpuneet S. Aidhy

Physics; Mechanical Engineering

University of Wyoming

Poster and Oral Presentation

*Wyoming Research Scholars*

*Rawlins, WY*

The uranium nitride family of nuclear fuels is proposed as a safer and more efficient alternative to oxide fuels in future generation IV nuclear reactors. However, despite this recent interest in UN, the energy required to form lattice-level defects, and how easily those defects can diffuse throughout the lattice, have yet to be comprehensively studied in a computational setting. Due to the high energy processes natural to a nuclear reactor, and, by extension, a high likelihood of point defects being formed in UN's lattice, understanding overall defect properties of UN is of critical importance for determining its reliability as a nuclear fuel. In our work, we calculate the point defect formation energetics and migration barriers of uranium vacancies, nitrogen vacancies, uranium interstitials, and nitrogen interstitials using density field theory calculations, helping us to determine how common each of these defects would be, and how easily they are able to migrate throughout the lattice. This knowledge will contribute to the overall design and development of UN as a future accident-tolerant nuclear fuel, giving us insight into properties of UN that would be difficult or dangerous to find experimentally.

**Evaluating Peripheral Sensitization of Chemically Induced Neuro-inflammatory Pain to Determine the Regulatory Role of Innate Immune Signaling**

Cortney Johnson, Shaonil Binti, and Guanglong He

School of Pharmacy

University of Wyoming

Poster

*McNair Scholars*

*Hulett, WY*

With a focus on potential immunotherapy for managing chronic pain, this experiment studies the pathogenesis and development of neuro-inflammatory pain stemming from nerve damage and neuro-inflammation as well as its connection to innate immune response in order to address the pressing clinical matter of neuro-inflammation and the affiliated neuropathic pain. Associated with immune cell activation and inflammation, CARD9 plays a key role in the regulation of innate immune response. Cytokines/chemokines are hypothesized to bolster neuro-inflammation and subsequently neuropathic pain by acting on Schwann cells in neurons. By continuous production of pro-inflammatory molecules, cytokines/chemokines expedite inflammatory cell infiltration. Macrophages and neutrophils are the major inflammatory cell types and thus, are the cells of interest. Additionally, CARD9 signaling is an essential aid in macrophage and neutrophil infiltration and cytokine/chemokines manufacturing in obesity-associated cardiovascular malfunction and myocardial infarction, implicating adverse effects on sterile inflammation. It is suspected that inhibition of CARD9 signaling would mar the inflammatory response to nerve damage or chemical induced neuro-inflammatory pain. This study is expected to illustrate an understanding of the mechanistic connection between CARD9 innate immune signaling and neuro-inflammatory pain.

**Fire-Cracked Rocks at Alm Shelter (48BH3457)**

Erin R. Kelley with Dr. Robert L. Kelly

Anthropology

University of Wyoming

Oral Presentation

*Honors*

*Castle Rock, CO*

Fire-cracked rocks have only recently become the main focus of archaeological projects to help us better understand the larger usage of a site. Several concentrated collections of fire-cracked rocks (FCR) were uncovered at Alm Shelter (48BH3457), a well-stratified rock-shelter in northern Wyoming, and are the focus of this study. Study of these rocks can help us to better understand how prehistoric people were using the site. Were these stones being used for stone boiling? Were they tools to help maintain the heat of a fire? Or were the fracture patterns we see at Alm Shelter created by entirely natural processes? If these fracture patterns were caused by human use, what can this usage tell us about the overall activity at the site itself? Limited experiments were conducted in the field in an attempt to understand the processes involved in the use of fire-cracked rocks, and that work will be discussed here.

## Synthesis of Sydnones and Triazoliumtriolates

Phillip Kelly and Dr. Navamoney Arulsamy  
Department of Chemistry  
University of Wyoming  
Poster Presentation

*Wyoming NASA Space Grant Consortium*

*Johnstown, CO*

Nitric oxide (NO) donors are desired for their potential application in pharmaceuticals. Thermally stable substances derived from less expensive organic substrates capable of releasing NO under physiological conditions are particularly suitable for such applications. Nitrogen-rich compounds are also viewed as potential explosives and rocket propellants. In this study, we have examined the reactions of NO with a variety of  $\beta$ -ketoesters and isolated new sydnones and triazoliumtriolates. The reactions without the addition of hydroxylamine lead to sydnones and those with hydroxylamine form triazoliumtriolates, a new class of heterocyclic nitrogenous substances. The reactions were carried out in high pressure reactors under anaerobic conditions and at -10 °C. The products are characterized by UV-vis and NMR spectroscopy. Single crystal X-ray diffraction was used for identifying one of them, potassium 4-isobutyrylsydnonate-N-oxide. Further study will be required to determine if the new products possess NO-donor or high energy density properties.

## Evaluation of micro-injection technique and viability of regulatory T-cells in peripheral nerve grafts

Michelle Kilpatrick, Yohannes Estifanos, Kelly C Santos Roballo, Jared Bushman  
School of Pharmacy  
University of Wyoming  
Poster Presentation

*INBRE*

*Cheyenne, WY*

Motor and sensory loss following peripheral nerve (PN) injury poses significant problems to patients and therapy options often involve transplants using either a donor allograft or patient autograft. Unfortunately, these methods are not without complications. For allografts, the concern of rejection and drug generated systemic immunosuppression make them a consideration only in situations when quantity of life is in question, which is not in the case of PN injury. Localizing immunosuppression is a possible way to circumvent the risks of immunosuppression and thereby allow use of PN allografts to regenerate PN defects. The Bushman lab has previously found that localized delivery of regulatory T cells (Tregs) via a hydrogel was effective. The objectives for this project were to evaluate the use of micro-injection as a means of targeted Tregs delivery. The initial goal was to establish protocols for microinjection into PN grafts, which was achieved with fluorescent beads. Subsequent experiments showed that GFP+ Tregs can be microinjected into PN grafts and that the GFP+ Tregs survive within the grafts for at least 24 hours when the nerve was stored in at media 37°C or in PBS at 4°C. This is a promising indication of this method of Treg delivery. Further experimentation will assess survival at longer time points and *in vivo* analysis.

## **Community Gatekeepers Training: An Initiative for Dementia Care**

Kasandra Kister with Dr. Robin Barry

Department of Physiology

University of Wyoming

Oral Presentation

*Honors*

*Riverton, WY*

Dementia is the loss of cognitive functioning and behavioral abilities severe enough to interfere with everyday life. Dementia ranges from mild to acute stages. Symptoms result when healthy brain cells stop working, lose connection with other neurons, and die. Dementia can be caused by many different diseases. Alzheimer's disease is the most common form of dementia, but other forms can result from thyroid problems and vitamin deficiencies (National Institute on Aging, 2017). Although dementia commonly occurs in older adults, it is not an inherent part of the aging process. The purpose of this project is to develop a program to educate community members to recognize signs of dementia. Approximately one-third of people with dementia live alone (Mirando-Costillo, 2010). These individuals may not realize they need assistance or may have difficulty getting help. Oftentimes they are at a greater risk for social isolation and loneliness, in addition to safety hazards such as wandering (Alzheimer's Society, 2014). This program teaches community members to be mindful of individuals with cognitive deficits and provide resources to those affected by dementia.

## **Environmental Sampling Drone**

Cody Perkins, Gavin Worden, Joseph Klebba, Chris Jaworsky with Dr. Robert Erickson

Mechanical Engineering

University of Wyoming

Oral Presentation

*Department of Mechanical Engineering*

*Laramie, WY*

Large pits filled with contaminated water are a product of many mining operations. Collecting water samples from mine pits is a dangerous task that requires skill and caution as the body of water is surrounded by steep inclines. A drone offers a much safer and quicker alternative. The Trihydro Corporation, headquartered in Laramie, endeavored to win a bid that required the employment of a drone to collect water samples in mining pits. Their efforts inspired the idea for the development of a more robust and reliable drone system for the collection of mine site water samples. The designed system consists of the drone and a water sampling apparatus tethered to the drone. It will be constructed of a floatation device and two separate bailers. The drone is flown to a desired location, where upon arrival it takes two water samples, one at the surface and one below the surface. The samples are then flown back to a location where they can be disconnected and transferred to the appropriate containers and testing facilities. The overall goal is to collect the samples such that they fit the specifications of the original bid pursued by the Trihydro Corporation.

## **Land Cover Analysis of Hybrid Zones of Indigo and Lazuli Buntings**

Adam Klessens, Libby Megna, and Matthew D. Carling

Zoology

University of Wyoming

Oral

*Department of Zoology and Physiology*

*Cody, WY*

Over time reproductive isolation causes species to diverge. This divergence could be caused by many barriers that prevented gene flow between species. If the two species come into contact, they may have the opportunity to hybridize. This could be caused by many factors, like song or plumage. Both song and plumage are interesting to look at, but they must interact on the landscape. In this study am examining two species that are known to hybridize. These species are Lazuli Buntings (*Passerina amoena*) and Indigo Buntings (*Passerina cyanea*). The goal of this study is to map out habitat types that both species inhabit during the breeding season. By using data collected from eBird and vegetation maps collected from the USGS GAP Analysis Program, a prediction of areas that hybridization could occur could be found. The study area chosen to create the model is the Front Range of Colorado. I am looking at vegetation types that both species are found to relate regions in Wyoming that may harbor the hybrid species. The vegetation areas that I am examining are shrubland, farmland, and forest edges.

## **Twenty-first Century Voting Rights**

Michael Koger, Sr. with Dr. Ulrich Adelt

African-American Studies

University of Wyoming

Oral Presentation

*African-American Studies*

*Laramie, WY*

This will be an oral power point presentation on voting rights in the United States. It will especially focus on the 2016 U.S. presidential election and the Alabama elections that year. Though the research will consider events which led to the current situation, it will mostly consider the 21<sup>st</sup> century. Sources of information will include newspapers such as *The New York Times* as well as black newspapers like the *Baltimore Afro-American*. It will also consider many scholarly journals such as the *Alabama Law Review*. Moreover, there will be an examination of issues such as voter identification, discrimination, suffrage, and racial segregation. The reference sources will be both primary and secondary. The Voting Rights Act of 1965 will be a major focus of the research. There is much information on the United States Supreme Court and the United States Department of Justice as these agencies have a strong influence over such issues. One will find through perusal of the legal literature that the laws regarding voting rights change with each U.S. presidential administration. In fact, 50 years after the Voting Rights Act of 1965, the High Court enacted a major change in 2015. This is an exciting topic which considers politicians, courts, non-profit organizations, and prior experience of lawyers who have long-examined these controversial issues.

## **Usual Allied Health Care Treatment in Parkinson's Disease**

Kirsten Kropkowski with Dr. Mary Jo Cooley Hidecker

Division of Communication Disorders

Poster Presentation

*Division of Communication Disorders*

*Colorado Springs, CO*

Parkinson disease (PD), the second most common neurodegenerative disorder affecting more than a million people in the U.S., has no cure (Nazarko, 2005). PD may affect an individual's ability to perform daily tasks. People with PD may receive allied health services to alleviate and delay degenerative symptoms associated with PD (Keus et al., 2012). No published research in the United States describes allied health care by people with PD. This research aims to describe "usual allied health care" in terms of speech- language therapy, physical therapy, occupational therapy, and pharmaceutical intervention, received by individuals diagnosed with Parkinson's disease. Researchers created a 22- question survey about demographics and health services received by adults with PD. Participants were adults 18 and older who are caregivers or individuals with a diagnosed case of Parkinson's disease. Data analysis included descriptive statistics. Sixty-one participants completed the survey. The most common type of physical therapy received was balance exercises (26.9%). The most common type of speech-language therapy received was Lee Silverman Voice Therapy (23.1%). The most common type of occupational therapy received was exercises to maintain/ strengthen every day activities (54.2%). Allied health care varied widely in the treatment of PD. Other than physical therapy, the utilization of other allied health care is disappointing since the majority of individuals could benefit from coordinated allied health care (Keus et al., 2012). Increasing the availability of allied health could lessen the burden and improve quality of life for people with PD.

## **Rolling into Host: A cross-county cycling trip raising awareness of America's affordable housing crisis**

Courtney Kudera, Dr. Diane Panozzo

Honors Program

University of Wyoming

Oral Presentation

*Honors*

*Baggs, WY*

Bicycling over four thousand miles promoting affordable housing, I witnessed the repercussions and efforts made concerning one of America's most concerning social and economic issues, affordable housing. As a Bike & Build participant, my team and I experienced and were able to directly discuss the issue as we crossed the southern United States. This creative project presents a portion of America's affordable housing struggles through a creative non-fiction narrative. While affordable housing is the focus, topics including cycling and communal living will also be addressed. Primarily, this creative non-fiction encourages discussion regarding affordable housing through an entertaining lens. Issues such as disaster relief, sustainability, temporary housing, as well as zero-waste construction will be discussed in their respective regions and states. First-hand experiences will be the primary focus; however, additional research-based information is also included regarding specific locations' affordable housing struggles. Characters will represent my teammates and our experiences as we crossed the country. This will include discussing interpersonal interactions with hosts, affordable housing affiliates, as well as other individuals met along the way. Each interaction and mention will highlight either communal living, cycling, or affordable housing. Stylistically inspired by Born to Run, the goal regarding this creative non-fiction is to be informative about an important issue while remaining entertaining.

**What effect do Black-billed Magpies (*Pica hudsonia*) have on the nesting habits of American Kestrels (*Falco sparverius*)?**

Shawna Lacey, and Dr. Scott Newbold  
Department of Life Sciences, Biology Program  
Sheridan College  
Poster

*Department of Life Sciences*

*Hayward, WI*

Although American Kestrels (*Falco sparverius*) appear to be common, long-term monitoring suggests populations in the Rocky Mountain Region may be in decline. Installation of artificial nest boxes can boost populations, but boxes can be targeted by predators. In previous studies at Wolf Creek Ranch, others found that raccoons were removing nestlings from nest boxes. Interestingly, this same study noted the presence of Black-billed Magpies (*Pica hudsonia*) at kestrel nest boxes, but no formal analysis of their interactions was conducted. In the current study, I used camera-trap data from 4 years on 5 nest boxes and nest-box occupancy data to investigate the extent to which magpies are a threat to American Kestrels nesting in artificial boxes. Magpies were observed at all 5 boxes, with a total of 89 kestrel-magpie encounters. Kestrel responses to magpies were starkly more aggressive than interactions with other avian species (e.g., European Starlings [*Sturnus vulgaris*]). Kestrels were extremely watchful of the magpies, often displaying defensively with puffed feathers or vocalizing. The most combative interactions involved chasing and collisions. Most significantly, a single photo showed a magpie flying away from a nest box with an egg pierced on its beak. The color and size ratio (magpie/egg) is consistent with a kestrel egg. Cameras installed inside nest boxes would provide additional insights into this interaction and show direct evidence of egg/nestling removal. Future conservation efforts should focus on excluding avian predators from boxes, perhaps by altering where boxes are located or modifying the size of the nest-entrance hole.

**The Madness in the Method: Mental Health of Students and Faculty in Academic Theatre Programs**

Kyriessa Lane with Patrick Konesko  
Theatre and Dance  
University of Wyoming  
Poster

*McNair Scholars*

*Littleton, CO*

This study will investigate the mental health of students and faculty engaged in academic theatre programs at the collegiate level. I hypothesize that the workload of some students and faculty in these programs will have a negative effect on mental health. Informal open-ended interviews and surveys will be conducted among faculty and students from the University Wyoming and other universities and community colleges in the rocky mountain region. Interview questions will be designed to gather data on participants' views of their emotional and mental well-being. Statistical analysis will be conducted at the end of the data gathering process. There is little research available on the mental health of individuals involved in academic theatre and its corresponding culture. This study could help to identify mental health issues among these groups, as well as to determine causes and find potential solutions to these issues.

## **Streats**

Larson Auston and Treavor Troughon  
University of Wyoming

### *Computer Science*

Streats is a platform that allows food trucks to better engage with their customers. Food trucks (and small businesses in general) lack an all-encompassing link to their customers because they typically can't afford to pay a team of software developers to create an application specific to their needs. Streats is a platform that allows food trucks to engage with their customers via a mobile app. The Streats app allows customers to locate food trucks near them, receive notifications when their favorite food trucks are having specials, and view menus of food trucks they aren't yet acquainted with. Furthermore, Streats provides a website by which vendors can register their food truck and start connecting with their customers. Through the website, vendors can create their menu, send push notifications to their subscribed customers, and configure how they want to track the location of their food truck.

## **Implicit Bias Jury Instructions**

Alma S. Lawson-Garcia with Lauren McLane  
Criminal Justice  
University of Wyoming  
Oral Presentation

### *Honors*

*Casper, WY*

The Sixth Amendment guarantees a defendant the right to an impartial jury; however, studies have shown that members of the jury are often unknowingly influenced by biases that are present in our social and cultural norms. Jurors, like all individuals have biases, both positive and negative, that can affect their decision-making. In order to ensure a fair trial, the jury must be aware of their biases, especially their implicit ones. Implicit biases are of particular concern because they are held at an unconscious level and can be extensive and difficult to change. The purpose of the following research was to determine whether all states in the United States should use implicit bias jury instructions in criminal trials. Implicit bias jury instructions introduce members of the jury to the concept of implicit bias and urges them to avoid such biases during trial. This research examined existing studies on implicit bias and explored the current and future use of these instructions throughout the country. Although further research is needed to understand the full extent of the effects of implicit bias jury instructions on a courtroom, current studies indicate positive results in reducing juror biases. These results could significantly impact the criminal justice system by ensuring a fairer trial for all defendants.

## **Biomedical Applications of Liquid Crystalline Elastomers**

Margaret Lichtenfels  
University of Wyoming

Liquid crystalline elastomers (LCEs) are polymers with high energy absorption capabilities and demonstrated biocompatibility, making them a strong candidate for biomedical applications. A current medical issue with limited treatment options is the degradation of cartilage in the metatarsophalangeal joint. This is a common occurrence, causing severe pain for hundreds of thousands of people in the United States. The available treatments are to either fuse the joint, limiting mobility, or to insert an implant to provide cushioning. The material currently used for the implant is a polyvinyl alcohol hydrogel which fails over time. LCEs are an alternative that could provide the mobility of a hydrogel implant, with the added benefits of longevity and excellent energy dissipation. The composition of LCEs can be manipulated to achieve specific mechanical properties ideal for the implant. LCEs are composed of polymer networks with rigid backbones that are loosely crosslinked. Crosslinking is the degree of bonding between polymer chains. The crosslinking density directly relates to the stiffness and energy absorption capacity of LCEs, and so various compositions can be tested to determine the optimal level. To simulate the application of the implant, each LCE was inserted into a hole with 20% of the implant projecting. The LCE was then cyclically loaded in compression at 1 Hz and 35% of the patient's body weight to mimic walking. Additionally, the mechanical properties of the LCEs were tested to assess the high cycle fatigue behavior.

## **Development of Red-Shifted Flavins for Optogenetics**

Shannon Linch with Dr. Karen  
Mruk Chemical Engineering  
University of Wyoming  
Poster Presentation

*Riverton WY*

Optogenetics is a powerful technique used for targeting light-sensitivity to cells of interest. Optogenetics allows for biological signaling with spatial and temporal precision, which means control of specific cell types in an exact location of interest in real time. This amount of control grants scientists the opportunity to study brain functions, treat arrhythmia, ablate cancer, and control bacterial growth. The emphasis of my project uses LOV domains; a novel platform for optogenetics. LOV domains respond to 470-nm light, we are working to develop LOV-flavin pairs that activate with longer wavelengths of light (red-shifted). This light can penetrate deeper tissues, permitting work on mammalian species. Organic synthesis is used to create extended conjugated flavins and molecular biology to create new LOV domains in order to observe and characterize the effect changes in protein conformation to activate signal transduction domains.

**SAE Formula Hybrid Suspension Design**  
Jacob Link, Brandon Richardt, Paul Wickberg  
University of Wyoming

Wyoming Motorsports is a student-led University Club that is engineering a formula-style racecar with intentions of competing in the Formula SAE competition. This project presents the second iteration design of the vehicle's suspension system. Analysis of the first iteration was used to drive design considerations on the second. SolidWorks was used to model the design. A MATLAB code is included that computed ideal mounting points for the front and rear A-arms to produce desired handling characteristics. Suspension geometry, A-arm's, uprights, pushrods, shock selection, and leverage curves are addressed. Ride analysis and bump steer are addressed within this work. This project includes in detail the engineering of a Formula SAE Suspension system and the way vehicle performance is affected under dynamic loading.

**Pathways from Prison: Parenting Programs and Sex-Offender Policies**  
McKenna Lipson  
University of Wyoming

The goal of this project is to present findings on two underrepresented subpopulations of inmates: parents and sex offenders. We studied the benefits and obstacles of implementing parenting programs in prison for incarcerated mothers and fathers. We reviewed texts that studied the well-being of children with incarcerated parents and suggested several approaches these incarcerated parents could use to improve their relationship with their child(ren). From there, we visited a Wyoming prison to experience the prison environment first-hand and share our research with the prisoners and faculty. After discussing our findings in prison, the final product of this study is a guidebook created for prison faculty summarizing how to establish an effective parenting program and its benefits. Additionally, we examined resources and barriers that exist for the reintegration of sex offenders into larger society. We engaged in an explorative, qualitative analysis of existing literature. Subsequently, the researcher compiled a thorough annotated bibliography and report of the findings. This information will ultimately be presented to the Department of Corrections. Parenting programs and sex-offender policies are marginalized components of an already forgotten population. The importance of these studies demonstrates the need for specific evidence-based prison programs and policies in order to reduce recidivism and strengthen communities.

## **Are Internalizing Symptoms Associated with Criminal Behavior in Married Couples?**

Alexis Lively with Dr. Robin Barry

Psychology

University of Wyoming

Oral Presentation

*Honors*

*Loveland, CO*

This study examined the relationship between internalizing symptoms and criminal behavior in married couples. Our study hypothesized that individuals who have engaged in criminal behavior will have higher levels of internalizing symptoms, specifically social anxiety, generalized depression, traumatic intrusions, and panic. Survey questions about internalizing symptoms along with questions regarding criminal behavior were used. 114 heterosexual couples, 18 and older, were used for the sample. Analyses were conducted by grouping the participants responses according to a 1-5 Likert and a True or False scale. Currently minimal research is done to understand the relationship between internalizing symptoms and criminal behavior in married couples. This study will provide new insight into this relationship.

## **Policing Since Ferguson:**

### **How the Shooting of Michael Brown Has Shaped Policing Practices**

BriAnna Logan with Dr. Kimberly Schweitzer

College of Arts & Sciences, Department of Criminal Justice

University of Wyoming

Oral Presentation

*Honors*

*Rock Springs, WY*

The August 2014 shooting of unarmed African American teenager Michael Brown by White police officer Darren Wilson in Ferguson, Missouri brought to life the Black Lives Matter movement, and brought media attention to police violence against Black individuals. This event was a catalyst for change in policing across the country. Interdisciplinary researchers are tracking the response of policing practices to public outcry following this shooting. Michael Brown's death—and the following riots in Ferguson—have resulted in changes in hiring practices, specialized training for officers involving cultural empathy and understanding, the increased use of body-worn cameras, and changes in some use of force.

## **Multistage Magnetic Coil Gun Project**

Garrett Lundy, David Wilson, Hannah Bertelson and Dr. Pikal  
Electrical Engineering Department  
University of Wyoming  
Poster Presentation

*ECE*

*Laramie, WY*

As a team we decided to build a multistage magnetic coil gun because of our mutual interest in electromagnetics and electronic design. Electromagnetic coil guns have a potential for having more energy compared to gas powered weaponry. Gas power weaponry is limited to chemical reactions and mechanical strengths, while coil guns are limited to the hardware available. On a large scale, coil guns must also be cautious of the heat dissipation, but on our small-scale design, heat was not an issue. During the course of senior design, the materials and methods needed to create a magnetic coil gun were investigated. After careful consideration we have decided upon creation of a six-stage design utilizing a microcontroller for monitoring and safety needs. A multistage design has the advantage of increased projectile muzzle velocity when compared to a single stage design. We used an IGBT as a switch, while running current through a solenoid, creating a magnetic field to launch a projectile.

## **Public PTSD Perception: First Responder and Military Member**

Bradley Lutz with Dr. Meg Flanigan  
Physiology  
University of Wyoming  
Oral Presentation

*Honors*

*Casper, WY*

PTSD has only been recognized as a diagnosable illness since 1980. Prior to that time, it carried other names such as Shell Shock or Combat Fatigue. Historical documentation of PTSD symptoms can be traced back more than a millennium however, to the writings of Homer and his poem *The Iliad*. In it, he describes Achilles as a Trojan War veteran who is continually awakened and tormented by thoughts of a fallen comrade. Contemporary research has shown that up to 90% of people diagnosed with PTSD have difficulty sleeping (Maher et al, 2006). Much of the existing research has been aimed at military members and veterans of military service who have a PTSD driven suicide rate nearly four times that of the general public (12.6 vs 44 per 100,000) (SCC, 2018). Almost no research exists which studies how PTSD affects U.S. first responders (Paramedics, Firefighters, and Law Enforcement officer), but suicide monitoring groups believe that the rate of suicide for first responders may be as high as 65 in 100,000 or 170% the military rate (SCC, 2018). The project goal was to determine if there is a discrepancy in public perception of PTSD and related suicide rates between military veterans and first responders. Using a Likert scaled survey, 284 people completed the survey. The data shows that citizens expect first responders to experience trauma more often than military members, while at the same time experiencing PTSD type symptoms to a lesser degree.

## **Hemoparasites: Determining Prevalence in Rocky Mountain Broad-tailed Hummingbirds**

Adrienne Mackenzie/Dr. Holly Ernest  
Department of Veterinary Sciences  
University of Wyoming  
Poster Presentation

*Department of Veterinary Sciences*

*Wright, WY*

Broad-tailed Hummingbirds (*Selasphorus platycercus*) are a critical component of ecosystems in the Rocky Mountains where they act as important wildflower pollinators. This migratory, high-elevation species is believed to be especially sensitive to shifts in flowering phenology caused by climate change. Changing habitats and climates will increase physiological stress and make hummingbirds in the Rockies more susceptible to disease. Of particular significance is the prevalence of three potentially pathological blood parasitic genera – *Haemoproteus*, *Plasmodium*, and *Leucocytozoon* – which have been documented in other hummingbird species throughout the Americas, especially in Central and Southern America (though hemoparasites have been detected in hummingbirds as far north as California). The presence and prevalence of these hemoparasites among Wyoming and Colorado Broad-tailed Hummingbirds has not yet been tested; however, these protozoal parasites have been implicated in decreased survival and reduced reproductive success in other hummingbird species. Broad-tailed Hummingbirds may experience these effects now, and to a greater degree in the future, making this research important for the current and future conservation of the species. Our study will use microscopy and DNA sequencing to test for the prevalence, diversity, and distribution of hemoparasites in over 100 Rocky Mountain Broad-tailed Hummingbird samples. We will then assess the relationship between hemoparasite prevalence and the spatial distribution of Broad-tailed Hummingbird populations. We intend for these studies to improve the long-term conservation of the species by providing landscape-scale population health information to support habitat management efforts.

## **Cooperation Behavior and How Parents Decide Whether to Vaccinate Their Child**

Alexander Marchal with Dr. Mariah Ehmke  
Economics and Agricultural Economics  
University of Wyoming  
Poster and Oral Presentation

*INBRE, Honors*

*Green River, WY*

Immunization behavior and policy has become an increasingly contentious discussion because of recent outbreaks. So far in 2019 there have already been 465 confirmed measles cases across 19 states in America (McKay, 2019) and national DTaP immunization rates have declined by 4% this decade (WHO, 2018). Understanding why parents elect not to immunize their children is important to develop methods of dissuading immunization reluctance. This paper examines parents' socioeconomic behavior and how it affects their decisions to immunize their child. More specifically, it aims to study the effect of free riding in vaccination decisions, and the social pressures that parents in rural communities in Wyoming feel. It looks at three different situations in which the personal connection to and contribution mechanism in a community are changed to evaluate how parents whom do not vaccinate their child act differently. This is done by analyzing play in a Voluntary Contribution Mechanism (VCM) game and by studying responses to survey questions which focus on parental community considerations in regard to vaccinations. Our results indicate that parents whom do not vaccinate do not have a higher propensity to free ride in the VCM. Rather, their decision is unique to community pressures and the individual vaccination situation.

**Safariland Senior Design Abstract**  
Brett Marin, Kyle Okray, Connor Wetzel  
University of Wyoming

The task for this project is to help improve the way the Research and Design Department of Safariland's Defense Technology records the accuracy data for new less-lethal ballistics testing. Currently the company operates by shooting a piece of cardboard and using a tape measurer to approximate an extreme spread, as well as the average drift and average drop from a bore sighted aim point. The goal of the project is to ensure that this data is recorded more accurately and reduces man hours spent on data acquisition at the same time. Two solutions are being heavily investigated. The first solution is the most optimal one because the data would appear in real time as the user tests the rounds. This fully automated method uses acoustics to locate the shot on a board. To achieve this, a frame would be made with piezo elements lining the outside of the frame; these piezo elements will record first arrival times of a vibration event and triangulate a position through those time differences. The second solution is less optimal because it would require user input after the shot is taken, thus, making it more time consuming. This method consists of developing a camera mount and cardboard mount in conjunction with creating a program using Microsoft Visual Basic code. This program will use an image that is uploaded by a user and prompt the user to select every shot location on the image to provide the necessary data. While this program is not as effective as the acoustic solution, it will still reduce the time spent recording data, while increasing the accuracy of the data.

**Jazz Poetry and Making Visible the African American Experience**

Shannon Marks with Scott Henkel  
English Department  
University of Wyoming  
Oral and Individual Presentation

*Honors Program*

*Cheyenne, WY*

My project is a written thesis on jazz poetry, specifically exploring selected poetry of Langston Hughes, Bob Kaufman, and Amiri Baraka. In this study, I contribute to the conversation about these poets by first, agreeing with research that claims politics and racial pride to be driving forces behind the poetry of these three men. I then expand upon this research by expressing that the poems and poets I have selected for this thesis supports the conceptual metaphor of CREATING IS MAKING VISIBLE in that jazz is what is being created, and what is being made visible is the African American experience as innumerable African Americans made the shift from post-emancipation America to finding a function in society, in the setting of the Black Arts Movement, active during the 1960s. Jazz is the only way through which African Americans are given a voice because it is the only vocation they could fill in white society, while still embracing their ancestry. Today, it remains a well-embraced artistic form of giving a voice to those who have been previously silenced. I began this project because jazz and poetry as separate entities are both really important to me and have become large influences in my life. African American Literature, and Linguistics continue to hold my interest as I probe deeper into both lines of study, unlocking the idea that communication is the key to success. Jazz poetry is the ground on which my interests intersect, and spiral into profound illustration of deeper meaning.

## **The Femme Fatale: Duplicity of Seduction and Innocence**

Mariana Marvel with Dr. Andrew Fitch

English

University of Wyoming

Oral and Poster Presentation

*English*

*Wasilla, AK*

Film noir as a genre has enthralled audiences for ages. Darkened alleyways, corrupt cities, sultry and deceptive women, and the adventurous private eye are all central themes that come out of film noir. Through mysterious murders and other seedy adventures, the detective (who is usually male) is able to solve the case. Most of the time, a beautiful, seemingly innocent woman is behind it all – she is known as the “femme fatale.” This project will provide an in-depth look at the femme fatale in film noir, and how she is positioned on screen. By analyzing various films from the 1940s, I will argue that the femme fatale as an archetypal character is often overlooked as seductive and manipulated, when, in fact, she is presented to the viewer as the ultimate object. The goal of this project was to focus on the representation of women on screen and how that aligns with gender dynamics in the World War 2 era. By engaging with feminist film theory and historical background, I provide a dual project, combining both critical and creative aspects. After looking at certain femme fatales from different movies, I engage the imagined perspectives of these women through both poetry and prose. The purpose behind this was to give a voice to these women who are so often silenced on the screen.

## **Converting Coal and Plastic to High Value Carbon-related Materials via Metal-Assisted Microwave Treatments**

Christoffer Masi, Dr. TeYu Chien

Department of Physics & Astronomy

Carbon, one of the most versatile elements, is found virtually everywhere in modern society, from fuel sources to waste. Coal is a prominent fuel source which is a mostly amorphous carbon structure containing aromatic rings and various functional groups. Plastic waste is comprised of carbon polymer chains with known constituents. A cost-effective method of converting these abundant carbon materials into a higher value form is highly desired. Here, a novel method of converting raw coal powders and plastics through use of metallic catalysts/substrates and a conventional household microwave is presented. Specifically, three major factors are varied: high temperature, catalyst, and environment. Microwave induced electric sparking (metallic catalyst) provides energy for the conversion. Metallic catalysts allow formation of nano-graphite or other 2D Carbon materials. A successful conversion of coal into nano-graphite will be presented. Alteration of the specific materials used may yield different materials, currently, this method provides an excellent alternative for waste plastics and excess coal.

## **Evaluation of Microbial Succession and Community Dynamics in Kimchi**

Paul Mathews with Dr. Bledar Bisha and Dr. Jill Keith

Animal Science and Family and Consumer Science

University of Wyoming

Poster Presentation

*WRSP*

*Boulder, CO*

Kimchi is traditional Korean dish produced from the spontaneous fermentation of brined cabbage, vegetables, dried chili pepper and fermented fish products. The microorganisms associated with kimchi fermentation are of interest for their functional, organoleptic, and preservative qualities. As the majority of microbiological studies have been conducted in South Korea, fermentation microbial succession and community dynamics in products from the Mountain West region of the United States were studied. Commercial and homemade kimchi were analyzed, and resulting microbial community evaluated to demonstrate the influence of region or ingredient variability. A secondary goal of this study was to compare the relative merits of quantitative real-time polymerase chain reaction (qPCR) and fluorescence in situ hybridization (FISH) as reliable methods for analysis of microbial communities in a complex matrix such as kimchi. Three trials of kimchi fermentation were conducted over a period of six months, involving two technical replicates per trial. Each trial was fermented for a period of 28 days, with microbial community assayed at intervals of 3, 7, 14, 21, and 28 days. Kimchi was prepared using regionally available produce and an accessible yet traditional recipe. Several organisms were targeted, all lactic acid bacteria (LAB) which are known to be primary fermenters and microorganisms of interest. Molecular techniques (qPCR and FISH) were employed to evaluate the succession and relative abundance of microorganisms. To this point, three fermentations and DNA extractions are complete, with molecular analysis to follow.

## **Glacier Recession on the Slopes of Mt. Kilimanjaro in Tanzania, East Africa**

John McCormick and Tobias Osborne

with Sarah Konrad

Central Wyoming College/University of

Wyoming/NOLS Poster Presentation

Central Wyoming College (CWC) students from the Tanzania Scientific Research Expedition traveled across the world to hone their scientific skills. From the slopes of Kilimanjaro from 5000feet to the summit at 19,341feet, student researchers posed questions about the local environment, formulated hypotheses, and conducted field-based glaciological research. This research effort involved a partnership between CWC, the University of Wyoming, and NOLS East Africa. The educational goal of this project was to help students expand scientific literacy while contributing to ongoing glacial ice research in collaboration with Douglas Hardy of the University of Massachusetts. The scientific goal was to measure the activity (growth, or ablation) of glacial ice forming Kilimanjaro's Northern Ice Field. Data was collected from a high elevation weather station and measurements were taken to assess the height of 12 previously positioned ablation stakes. GPS units were used to find and record numbered stakes and each stake height relative to both snow and ice height was measured and recorded. A comparison of the 2019 data to previous years indicated that there has been significant accumulation (mean=12cm, sd=12.8cm) on the glacier over the past year. Although the positive trend of this year's data opposes other recent years, it is not uncommon to have fluctuations in ice depth even within the context of a receding glacier overall.

## **Assessing Parent Satisfaction and Child Outcomes: A Qualitative Evaluation of a Community-Based Exercise and Nutrition Program**

Brittany D. McDonald and Cynthia M. Hartung, Ph.D.

Psychology

University of Wyoming

Oral Presentation and Poster Presentation

*Honors*

*Cody, WY*

The Healthy Kids Rx program (HKRx) is designed to increase physical activity and nutrition knowledge in youth. Exercise and nutrition, especially when incorporated into a community-based intervention (Inman et al., 2011), has shown to increase health and wellness, cognitive functioning, and academic achievement (Correa-Burrows et al., 2017). The aim of this study is to evaluate the accessibility and feasibility of HKRx using parent feedback from twenty-nine surveys. Survey questions were open-ended and used to query parents on perceived improvements in physical activity, nutrition knowledge, and enjoyment of the program. A variation of grounded theory analysis (Creswell & Poth, 2018) was used to develop emergent themes and sub-themes based on survey responses. Themes that emerged during the analysis included community support/acceptance, parent observed physical/emotional improvements, novelty in activities, and family lifestyle changes. Consistent with past research (e.g., Davies et al., 2016), these themes reflected the three aspects of the Self-Determination Theory, suggesting the program targets relatedness (i.e., community amongst peers and coaches), autonomy (i.e., personal choice in acquiring knowledge and fitness goals), and competence (i.e., building personal skills and knowledge of nutrition and physical activity) for youth. Findings suggest parents accept the program because of positive youth outcomes and the desire for continued participation. Parents' recommendations to improve program included changing the class times combining certain age groups, among others.

## **Phylogenetics of Selenium Tolerance and Antioxidant Capacity in Fungal Isolates from Lysite, WY, USA**

Allyson N. McKinney, Katherine M. Peel, Andrea A. Waltjen, Dr. Zachary P. Roehrs,

Dr. Courtney L. Springer, Dr. Ami L. Wangeline

Department of Natural Sciences

Laramie County Community College

Poster Presentation

*Department of Natural Sciences, INBRE*

*Cheyenne, WY*

Selenium (Se) is a rare trace element in most environments; however, Se is plentiful in the Wind River basin shale deposits. Shale weathering exposes Se deposits to nearby plants and fungi. Despite not requiring Se, are thriving in these Se rich soils. This study aims to examine how rhizosphere fungal communities isolated from areas near Lysite, WY can live in this Se rich environment that would typically be toxic. Previous work has found that Se tolerance of various fungal isolates positively correlates with antioxidant capacity. However, these isolates have yet to be taxonomically identified. The goal of the current study is to identify the isolates to genus in order to investigate the correlation between Se tolerance and antioxidant capacity in an evolutionary context. Fungal tissue was grown on full strength Difco malt broth, vacuum filtered and prepared for extraction by either lyophilization or grinding in liquid nitrogen. DNA was isolated and targeted segments of the Internal Transcribed Spacer region (ITS1 and ITS4) were amplified using polymerase chain reaction. BLAST was used to identify these isolates to genus, and phylogenies were generated using Bayesian analysis. This research will provide a greater understanding of these species of fungi and the relationship between Se uptake and antioxidant capacity, and their evolutionary history.

## **Ethical Considerations of Autonomous Vehicles**

Kathryn McVicker with Professor Ed Sherline

Philosophy

University of Wyoming

Oral presentation

*Honors*

*Cheyenne, WY*

From Batman to Minority Report to Ender's Game, autonomous vehicles have been a prominent feature of science fiction, representing a futuristic society that could occur only in one's wildest imagination. However, that future is slowly becoming a reality. In 2009, the Google-run project Waymo began developing a self-driving car project. By 2018, more than two million miles had been driven by Waymo's autonomous vehicle. It is easy to understand why these companies have an interest in developing a marketable autonomous vehicle. In 2016, The National Highway Traffic Safety Administration reported that human error is involved in 94 to 96 percent of all motor vehicle crashes. There has also been a 5.6% increase in traffic fatalities between 2015 and 2016, increasing from 35,485 deaths in 2015 to 37,461 deaths in 2016. That means that a conservative estimate of the total traffic deaths caused by human error in 2016 is 35,213.34. Autonomous vehicles have been predicted to eliminate 90% of traffic accidents due to their elimination of human error. However, there will inevitably be traffic crashes involving autonomous vehicles.

## **Changes in CD4 T Cell Dependent IL-12 Production of *Toxoplasma gondii* Vaccination**

Nina Milani with Dr. Jason Gigley

Microbiology

University of Wyoming

Poster Presentation

*Immunology Department*

*Woodbridge, VA*

*Toxoplasma gondii* is one of the most common parasites in the world. This parasite causes the disease toxoplasmosis and can affect most warm-blooded animals. Cats are the reservoir for this parasite and excrete cysts that can infect other animals, including humans. This parasite affects more than 40 million people in the United States (CDC, 2018). Although some people affected with toxoplasmosis may have swollen lymph nodes or some flu-like symptoms, most people show no symptoms. This parasite can cause life-threatening disease in individuals that are immunocompromised. The goal of this project was to determine if Interleukin-12 (IL-12), a proinflammatory cytokine, is needed for the natural killer (NK) cell response during *Toxoplasma gondii* infection in absence of CD4 T cells. Enzyme-linked immunosorbent assay (ELISA) was used to measure the concentration of IL-12 in mice vaccinated with *Toxoplasma* strain cps1-1 compared to non-vaccinated mice. In each vaccination group, a control group of mice with normal CD4 T cells was compared to the experimental group of mice with depleted CD4 T cells.

## **Distributing REDD+ Benefits Among Indigenous and Rural Citizens in the Peruvian and Brazilian Amazons**

Lauren Miller

The Brazilian and Peruvian Amazon Rainforests host some of the most biodiverse habitats in the world. This biodiversity holds present and future monetary and intrinsic value to local and international communities. However, it is threatened by high rates of deforestation. The “reducing emissions from deforestation and forest degradation in developing countries” (more commonly known as REDD+) program by the UN provides compensation for the preservation of developing countries’ forest stocks. While beneficial in some ways, many rural and indigenous citizens are negatively affected by REDD+ because of job loss tied to deforestation reduction. This often leads to illegal, increased deforestation because the citizens do not have an incentive to stop deforestation. The REDD+ payment allocations are regulated through a system of seven “Safeguards”, essentially stipulations or policies, which are monitored to help ensure compliance on the part of the recipient country. While two Safeguards address rural and indigenous people, the Safeguards are relatively ambiguous and may not be effective when implemented in a developing economy with possible political corruption. This corruption interferes with payment distribution causing money to go to corporations or national matters and to not reach rural and indigenous citizens. By improving the current Safeguards, adding additional Safeguards, and more heavily monitoring payment distribution, REDD+ can be more effective. When considering the Safeguards, two additional components to consider are implications with indigenous and rural land tenures and potential financial gains from cultural Intellectual Property rights.

## **Graphene Synthesis from Hydrocarbons Using Chemical Vapor Deposition**

Ryan Miller with Dr. Rob Milne

Natural Science Division

Sheridan College

Poster Presentation

*Sheridan College*

*Sheridan, WY*

Graphene is a two-dimensional hexagonal arrangement of  $sp^2$ -hybridized carbon atoms. Graphene exhibits unique physical, mechanical, and electrical properties. Graphene’s pi electrons explain its exceptional conductivity. Its high strength-to-weight ratio could be used to enhance current products such as concrete. While several methods for producing graphene have been investigated, chemical vapor deposition (CVD) appears the most promising. This research involved a stainless-steel chamber placed in a furnace between 600 and 1000 °C. A constant flow of argon was used to deliver various ratios of a gaseous hydrocarbon source. Metals, such as copper, were used as a deposition surface for the carbon. Results were evaluated using Raman spectroscopy.

## **MALDI-TOF MS Whole Cell Bacteria Analysis**

Hannah Mills with Dr. Franco Basile

Chemistry

University of Wyoming

Poster Presentation

*INBRE*

*Laramie, WY*

Although many methods exist for identification of microorganisms at species level, identification of bacteria at strain level is challenging requiring higher selectivity. Strain categorization is needed in medical settings to define bacterial strains in terms of origin, antibiotic resistance, and pathogenicity (Sandrin, Todd R, et al). Due to the simple sample preparation and the rate at which data can be acquired, matrix-assisted laser desorption ionization time-of-flight mass spectrometry (MADLI-TOF MS) has been of interest in the field of microbial identification (Sandrin, Todd R, et al). When looking specifically at whole cell bacteria, MALDI-MS has the ability to differentiate a wide range of microorganisms, requires minimal sample pretreatment, maintains high sensitivity, covers a broad mass range, and has the ability to generate singly charged high mass protein ions that can serve as biomarkers for identification (Toh-Boyo, Gwendoline M, et al). The goal of this project was to focus on the need for increased profile quality, reproducibility, and mass accuracy through the optimization of preparation methods for species-level profiling of 10 different *Escherichia coli* S2 strains. The sample preparation/deposition methods investigated included the dried droplet, premix, and Bruker method. The MALDI mass spectral profiles were compared via pattern recognition through PCA for all sample deposition methods. Throughout comparison of the mass spectra, it is possible to see significant peaks that are reproducible and unique to the individual strain. Although biomarker and library identification was beyond the scope of this research, MALDI-MS analysis can in fact differentiate between the strain level of a bacteria such as *E. Coli*.

## **Improving HVAC Performance for Legacy Molding**

Andrew Molder with Dr. Kevin Kilty

Mechanical Engineering

University of Wyoming

Oral Presentation

*Engineering*

*Laramie, WY*

This Senior Design Project utilizes computer generated models to improve HVAC systems in challenging environments, namely Legacy Molding's headquarters. Plastic and fiberglass molding machines generate high heat loads requiring substantial HVAC systems to produce comfortable work station temperatures. Smaller molding businesses, like Legacy Molding located in Riverton, Wyoming, are commonly housed in relatively small buildings not designed for extreme heat loads, further complicating a possible HVAC solution. By integrating experimental data into a three-dimensional thermodynamic computer model, this report can conclude that Legacy's current HVAC system (or other similar systems) can be improved by repositioning ductwork and molding machinery. However, completely replacing elements of the system is ultimately recommended to ensure reliability and longevity.

## **The Synthesis of Molecular Probes for the Selective Modification of Amino Acid Residues**

Tyler Myers with Dr. Michael Taylor Chemistry  
University of Wyoming Oral Presentation

*Wyoming Research Scholars Program (WRSP)*

*Sheridan, WY*

The capability to mimic nature's ability to selectively modify proteins through synthetic chemistry impacts the interface of biology and chemistry and can directly improve the human condition. While there have been many impressive attempts, the scope of chemical probes that are *truly* able to react with proteins selectively under biological conditions is scarce. Therefore, the aim of this research is to develop new, *chemically distinct*, reagents for selective protein modification. We consider tryptophan (Trp) to be a target of particular interest as it is a low abundance, naturally occurring amino acid; making it ideal for selective reactions. Additionally, Trp has the greatest potential for photochemical reactivity due to it being the most photolabile of all the naturally occurring amino acids. Photochemical reactions are of interest due to their ability to control spatiotemporal reactivity, ideal for chemical biology. We have designed and synthesized a variety of *N*-carbamoyl pyridinium salts that, upon irradiation with UV-B light, have shown complete tryptophan selectivity in a range of peptides and proteins. Furthermore, an additional bifunctional molecular probe has been synthesized that is designed to use the side chain of lysine as a directing group and generate a highly reactive benzyne in the presence of fluoride, which we have predicted could react selectively based on proximity to a given nucleophile.

## **Asphalt Plant Quality Control Sampler**

Ali Neuens & Jayson Rezek with Kevin Kilty  
Mechanical Engineering  
University of Wyoming  
Oral Presentation

*Mechanical Engineering*

*Centennial, CO | Sutherland, NE*

Granite Construction is a leading diversified infrastructure and construction materials provider in the country. Granite currently operates an asphalt plant in Tucson, AZ (Swan Road Hot Plant) where they crush their own aggregate and make asphalt for surrounding construction projects. With the current plant configuration and operating procedures, the plant must shut down multiple times each day to gather samples from each stockpile to assure consistency. These shutdowns result in extra wear on the plant and operating time lost, costing Granite. In order to reduce shutdowns, Granite approached the University to design a sampler that can be used to collect the samples while the plant is running. The goal of this project is to design and build a prototype sampler that Granite can utilize while the plant is operational. The most important constraint is safety; the sampler must not interfere with any safety guards and anyone operating the sampler must be able to do so safely. The sampler must be able to fit in the tight area between the drop point and the main transfer belt. It must also operate consistently in the harsh and dusty environment. After multiple design considerations and adjustments the sampler was made from a simple bin mounted to a frame that hinges for the sample to be transferred to a collection bucket. The bin and frame roll into the path of the falling aggregate on captive wheels on "V" track to prevent aggregate build up.

## **Dissin' Franchise: An Exercise in Entertainment Writing**

Alex Ray Nicholson, with Dr. Kaatie Cooper

Communication & Journalism Department

University of Wyoming

Oral presentation

*Honors*

*Burlington, WY*

Fandom culture has increased exponentially due to the rise of social media. Due to this increase, entertainment journalism has transitioned from just focusing on new information as it is released, but also occasionally focusing on public reaction to not just large events but to smaller ones, such as reactions to 20-second teaser trailers released a year ahead of a film's planned release. There is also an increased focus on film series, including sequels, prequels, remakes or even complete franchise reboots. While not inherently new to the medium of filmmaking, it does have an interesting effect on modern audiences, especially when it comes to the wider social connections in modern society. I started a blog called Dissin' Franchise where I could specifically focus on issues related to fandom culture and filmmaking. As a Journalism major, I tried to balance between an academic, journalistic and personable writing style in order to make it credible and entertaining. For part of the project, I am writing reviews of Western genre films in order to look at how popular perspectives of the American West have evolved over time. The other part is in-depth, research-based essays on specific topics in entertainment, such as the announcement of *Ghostbusters 3*, female-led superhero films such as *Captain Marvel*, and mythologizing and world building in *Star Wars*, particularly in the recent films. For my presentation, I will focus more on the three essays, as they are contemporary and connected to my main topic.

## **Cluster High Performance Computation**

Jarrett Nordin

University of Wyoming

For all large computing problems posed in the world today, there are cluster computer systems attempting to find solutions. From compiling vast images of the cosmos, to tracking weather patterns, to managing petabytes of consumer data, all of this is done with multimillion-dollar cluster systems. The only problem with these systems is the price associated with them. By utilizing Raspberry Pi boards, these computational capabilities can be delivered to ordinary users. At the price of only \$35 per board, powerful cluster systems can be made available at the price of a few hundred dollars rather than a few thousand. These computers utilize high frequency multicore ARM processors meaning that they are capable of any number of tasks. Cluster systems also function with any number of added computers so all assembled systems can be tailored to the requirements of the user based on processing power and budget.

## **Specific Binding of PopZ protein**

Isabel Noyes, Grant R Bowman

Molecular Biology

University of Wyoming

Poster

*McNair and Wyoming Research Scholars*

*Laramie, WY*

This study will investigate what structures and sequences the PopZ protein can bind to. I hypothesize that PopZ will only bind to a specific sequence or sequences. The experiment will be conducted using *E. coli* bacteria along with the plasmid GB1331, PCR template JH79, and a forward and 2 reverse PCR primers. The plasmid will be grown and purified. The template will be amplified through a PCR reaction. The plasmid and the PCR template will be used in *E. coli* to study what and how the PopZ protein binds. This research is important because the PopZ protein is a very important polar organizing protein that is vital during cell division.

## **Autonomous Indoor Drone**

Henry O'Meara and Jeffrey Wen with Dr. Suresh Muknahallipatna

Electrical Engineering

University of Wyoming

Oral and Poster Presentation

*Department of Electrical Engineering*

*Laramie, WY*

The need for autonomous indoor drones arises for search and rescue, inspection, and mapping purposes. This project aimed to address those needs by developing a drone capable of autonomously navigating an indoor environment using a combination of sensors. The unmanned aerial vehicle (UAV) was designed to be able to autonomously takeoff, navigate, and land while creating a map of the surrounding area. The Intel Aero Drone was selected for this project because of its appropriate size for indoor flight, ability to run algorithms from an onboard computer, and capability to interface with additional sensors. A horizontal 2D Light Detection and Ranging (LiDAR) distance sensor and downward-facing LiDAR sensor were added to the drone to increase the drone's spatial awareness and allow it to navigate in a GPS-denied environment. This combination of sensors provided the necessary hardware to detect objects around the drone as well as estimate the relative altitude. To control the drone, a Python program was developed which utilized MAVLink messages and DroneKit functions to send navigational commands from the onboard computer to the flight controller. An open-source Simultaneous Localization and Mapping (SLAM) library was used to localize the drone and produce a map of the surroundings. The updated map was processed to determine the next desired waypoint of the drone. The combination of these components provided a platform capable of achieving autonomous flight.

**The Physician Assistant (PA) Track:  
Six Tasks To Complete Prior To Applying For PA School**

Jessica O'Neal with Dr. Annie Bergman  
University of Wyoming  
Poster Presentation

*INBRE*

*Rock Springs, WY*

Whenever applying to any graduate program, one should consider the requirements well ahead of time, and it helps to break them down into steps or tasks. This poster focuses on the qualifications necessary to apply to a Master of Physician Assistant (PA) program. Though these tasks are the minimum requirements for admission to PA school in particular, they would likely be helpful to anyone who is intending to apply to some form of professional school. Because steps may infer a sense of time or scaffolding, I present the requirements as tasks that might be done concurrently: completing undergraduate education requirements, obtaining clinical hours, requesting references and writing a personal statement, shadowing in the job field, conducting research as an undergraduate, and taking the standardized exam. Approximately 240 physician assistant programs are currently operating and accredited in the United States. Gaining acceptance into one of these programs is highly competitive. That said, completing these six tasks may help an individual stand apart from other applicants.

**Understanding Asialylation of GM1 on T cells during avirulent *Toxoplasma gondii* infection**

Jess Oldham and Jason P. Gigley  
Department of Molecular Biology  
University of Wyoming  
Oral Presentation

*Department of Microbiology*

*Lander, WY*

*Toxoplasma gondii* (*T. gondii*) is a globally recognized, intracellular parasite that infects more than 40 million people in the United States. Individuals most at risk are immunocompromised patients and the developing fetus. Understanding the development of immunity is essential to for rational design because there are no effective vaccines or therapies that can prevent or clear infection. Natural killer (NK) cells and T cells are essential for control of the parasite. However, the factors that regulate the function of these immune cells during *T. gondii* infection are not well understood. NK cells are known to have constitutive high concentrations of the asialylated form of the glycolipid GM1 (ASGM1) on their surface. ASGM1 may also be expressed on T cells but unlike NK cells can be upregulated in some infections suggesting that it is important for T cell function. How ASGM1 concentrations change on T cells during acute avirulent *T. gondii* infection is unknown. Here we present data on how ASGM1 levels change on T cells after infection. These results will help inform on how glycolipid modifications may impact T cell function.

**Reverberation Mapping of NGC 2617**  
Kianna Olson with Dr. Michael Brotherton  
Physics and Astronomy  
University of Wyoming  
Poster Presentation

*Wyoming Research Scholars Program*

*Laramie, WY*

Active galactic nuclei (AGNs), powered by accreting supermassive black holes, are some of the most energetic objects in the universe and worthy of intensive study. In the MAHA (Monitoring AGNs with H $\beta$  Asymmetry) project, we are using the University of Wyoming's Infrared Observatory (WIRO) to obtain time-series spectroscopy of asymmetric H $\beta$  lines in order to map their broad-line emitting regions (Du et al. 2018, ApJ, 869, 142). Determining how the emission line reverberates in response to variation of AGN power allows us to determine the size scale and dynamics of the region. This information then allows us to determine the mass of the black hole powering the AGN. My focus in the MAHA project is NGC 2617, a changing look AGN that is known to vary dramatically allowing for unique mapping opportunities. This object is also being observed in the x-ray wavelengths and has been found to demonstrate large amplitude variability in both the x-ray and optical (Oknyansky, et al. 2018, PoS, 328). This variability along with recent changes in its H $\beta$  line makes NGC 2617 an especially interesting object to study.

**Hybridization in Lake Kivu Cichlids**

Reid Olson with Dr. Catherine Wagner  
Botany  
University of Wyoming  
Oral and Poster presentations

*WRSP and INBRE*

*Casper, WY*

Mechanisms behind the adaptive evolution of the Lake Victoria Region Superflock (LVRS) cichlids of the East African rift lakes have yet to be explained. Previous research suggests a hybridization event between ancestral Upper Nile and LVRS lineages may have facilitated this diversification. Using whole genome sequences, we look for signatures of hybridization events between Upper Nile and LVRS, comparing lineages from Lakes Kivu, Edward, and Victoria. Our results suggest differential hybridization between Upper Nile and LVRS lineages between these lakes. These results set up future work looking for evidence of selection on variation in hybrid ancestry of LVRS cichlids.

## **The impact of voluntary exercise on cardiac remodeling in young and old mice**

Ian Ostler with Dr. Danielle  
Bruns Kinesiology and Health  
University of Wyoming  
Oral Presentation

*INBRE*

*Dayton, WY*

Cardiovascular disease (CVD) is the leading cause of death in America. According to the American Heart association, there are 7 metrics to basic cardiovascular health: smoking, body mass index, total cholesterol, blood pressure, fasting plasma glucose, and physical activity/exercise. While the majority of these metrics have been improved over the past decade, physical activity has remained the same, if not worsened. Exercise is known to be one of the best ways of creating a healthy heart, yet many of the biological mechanisms influencing the heart remain poorly understood. The right heart has been scientifically neglected, yet it is the key determinants in mortality rates in humans. Along with Dr. Danielle Bruns and Emily Schmitt, I examined the effects of exercise on the right side of the heart (unlike the traditionally studied left side). We exposed young (8 weeks) and old (18 months) mice to voluntary wheel running or sedentary conditions. After four weeks, both cohorts will be harvested and the right ventricles captured to analyze protein expression of molecular mediators of physiological cardiac hypertrophy. Future experiments will determine if exercise can be used as medicine in mice with right-sided heart failure.

## **Simulating the Short Baseline Array of the ngVLA**

Rachel Parziale with Dr. Brian Mason  
Physics and Astronomy  
The National Radio Astronomy Observatory  
Oral Presentation

*Honors*

*Littleton, CO*

Next Generation Very Large Array (ngVLA) is a centimeter-millimeter interferometer consisting of a main array with 214, 18 meter antennas. The largest scale structures the ngVLA can observe are determined by its shortest baselines, which are limited by the diameter of the antennas. The main array by itself achieves insufficient resolution for all science projects planned for the ngVLA. In order to observe the largest scale structures, the ngVLA will also contain a compact, centrally-located array of antennas in a short baseline configuration referred to as the Short Baseline Array (SBA). The SBA will contain 19, 6 meter antennas. Two different configurations for the SBA were investigated: one configuration with regularly spaced antennas and one configuration with randomly spaced antennas. The configurations were investigated by simulating observations of sky images and simulated disks to investigate the PSF deconvolution of the observations and the flux recovery at different scales. The results show that, although it produces more prominent sidelobes, the regularly spaced SBA configuration recovers more flux density than the randomly spaced SBA configuration on scales larger than a diameter of ten arcseconds.

## **Smart Home System**

Krunal S Patel with Dr. Steven Frank Barrett and Dr. Cameron H G Wright  
Electrical & Computer Engineering  
University of Wyoming  
Poster Presentation

*EE/CPEN*

*Riverton, WY*

This presentation contains a description of my upcoming senior design project, **Smart Home System**. The system will make your home fully automated from the moment you enter until you leave. The primary system, which is going to have a facial recognition system, is going to control your home's main doors, lighting and ventilation systems, which makes it easier for you to get in and out of the house. The technology that I am going to use for facial ID is called the Template Matching functionality proved by OpenCV. Template Matching is a method for searching and finding the location of a template image in a larger image. It slides merely the template image over the input image as in 2D convolution and compares the template and patch of input image under the template image (OpenCV: Template Matching). To show my complete working prototype, I have come up with a small dimension model home (.5'H, 1'L, 1'W). It's going to have a living room, bedroom 1 and bedroom 2. There is also going to be Front Door. This system is not impacting the environment, but it helps the environment by saving electricity by implementing Smart Controller's System. Due to continuously rising electricity costs and environmental impact issues, this is an efficient solution to new upcoming Smart Home Systems. This Project is just a small footprint in a smart home system compared to today's market.

## **Remotely Controlled Robotic Hand**

Reenu Paul with Dr. Suresh Muknahallipatna  
Electrical Engineering  
University of Wyoming  
Oral and Poster Presentation

*Department of Electrical and Computer Engineering*

*Chennai, India*

This project involves the design and construction of a remotely controlled robotic hand that would have the ability to mimic the precise finger movements of the user's hand. With the help of two primary components, the Leap Motion Controller and the Raspberry Pi, it will be possible to measure and record the movements of the user's hand and relay the information to the robotic hand. The proposed design potentially has several merits related to use in remote applications. One of the main advantages of using a sensor like the Leap Motion Controller, is that it does not need to be in the same room as the robotic hand. As long as both devices are connected to the same network, the sensor will be able to relay the information directly to the robotic hand without much noise. This remote functionality proves to be useful in safety applications, for instance, investigating bomb threats and bomb defusing. Other applications include sample collections and space exploration activities. The remotely controlled robotic hand provides more precise movements and eliminates the need for a user to be in the vicinity. Ultimately, the primary goal of this project is to gain a better understanding of computer networks and transmit data from the sensor to the servo motors with minimal latency. With implementation of these algorithms, it would be possible to control the robotic hand from anywhere in the world.

## **Development of a diagnostic qPCR assay for *Mannheimia haemolytica* in Bovine Respiratory Disease**

Hannah Peterson

with, Hally Killion, Dr. Donal O'Toole and Dr. Kerry Sondgeroth

Department of Veterinary Sciences

University of Wyoming

*Orange County, CA*

Bovine respiratory disease (BRD) is a problem for cattle producers; causing annual losses of \$2-3 billion.<sup>1,2</sup> BRD is due to a multifactorial infectious process with stress predisposing cattle to viral and bacterial infections, some fatal. Common bacterial pathogens include *Mannheimia haemolytica*, *Mycoplasma bovis*, *Pasteurella multocida*, and *Histophilus somni*. The Wyoming State Veterinary Lab (WSVL) cultures suspected BRD samples. Since multiple types of bacteria are commonly involved, accurate diagnoses are difficult. The more abundant bacteria, *M. haemolytica* and *P. multocida*, will outgrow the fewer *H. somni* in a given sample. Due to inaccuracy, molecular diagnostic assay at WSVL is needed. This project developed a qPCR assay for *M. haemolytica*. Tissue samples were collected and archived from 2016 to 2019 following submission of tissues from cattle that died of BRD in Wyoming. A total of 46 culture positive tissue samples were retrieved from the archive. DNA was extracted from tissues, and qPCR was optimized for each of the bacterial targets using primers and probes developed by collaborators at University of Nebraska-Lincoln. This presentation highlights the steps taken in this project with the goal of developing a multiplex qPCR assay more sensitive than bacterial culture identification for the common bacterial components of BRD. This assay will eventually be utilized by WSVL for routine diagnostic testing of suspected BRD cases.

## **An Investigation Into Radioactive Contamination of Groundwater From Historic Uranium Mine Tailings on the Wind River Indian Reservation, Fremont County, Wyoming**

George G. Sims and Dustin R. Proctor with Professor Jaquelyn Klancher, Faculty Mentor

Central Wyoming College

Poster Presentation

*Alpine Science Institute*

*Lander, WY*

This research explores the presence, movement, and severity of radioactive groundwater contamination caused by historic uranium ore processing in Fremont County, Wyoming. In compliance with the federal law, two expedition science students from Central Wyoming College, in collaboration with the Stanford University Linear Accelerator Center and the US Department of Energy, conducted weekly sampling of groundwater, and analyzed pH levels and conducting spectrophotometric analyses to determine levels of total iron and Fe<sup>2+</sup> ions in the samples. Additional samples helped determine composition of other elements in the groundwater. Concentrations of contamination were predicted to be eliminated within one hundred years through natural attenuation. Data and analysis to date demonstrate that uranium contamination continues to migrate through the surficial aquifer toward the Little Wind River. At present, relatively high concentrations of uranium exist in the soil at the sampling site, approximately one hundred yards from the river. Observed contamination concentrations tend to exhibit seasonal vertical migration within the groundwater, based upon variations in soil saturation, and levels of contamination continue to *decline* as the pollutants migrate towards the Little Wind River. Based on this study, it is concluded that the natural attenuation of the contaminants is generally effective. Monitoring will continue through the coming seasons to gather additional data to support these conclusions.

## **Sinclair Capstone Design Mobile Boiler Project**

Riley Quigley, Addie Shafer, Zak Zenefski, with Nathan Benzel (Project Manager)

University of Wyoming

Oral Presentation

*Department of Mechanical Engineering*

*Sinclair, Laramie, WY*

Wyoming Natural gas fired boiler systems are located in power plants and oil refineries all over the world, many of which are designed to generate electricity. The processes in which these power stations generate electricity is not widely known by the general public, or employees beginning training in their operations. The idea of a mobile natural gas-powered boiler system is to simplify the combined cycle process for easier training and mobility. Originally proposed by Sinclair Oil Refinery in Sinclair, Wyoming to train boiler operators on standard operating procedures, the system is now sponsored by The Carbon County Higher Education Department. The mobile boiler is to be utilized in educating students across the State of Wyoming on boiler operations. Design and construction of the system is to include senior design teams of three consecutive years in cooperation with Sinclair. Each year's design team will provide an assigned list of deliverables, respectively provided by Sinclair's Project Management.

## **Effectiveness of First Year Seminars at the University of Wyoming**

Brett Ralston with Janel Seeley and Mark Lyford

Microbiology

University of Wyoming

Oral Presentation

*Honors College*

*Encampment, WY*

First Year Seminars (FYS) have been incorporated at over 90% of four-year institutions (Goodman and Pascarella, 2006), with the University of Wyoming being no exception. FYS are supposed to increase student success by adjusting incoming freshman to the academic lifestyles. Five typologies of FYS exist that universities practice for achieving this (Barefoot and Fidler, 1992). The University of Wyoming's typology is an academic seminar with various topics, rather than a generalized topic across all freshmen FYS. This allows FYS instructors to choose creative topics as long it meets the university's 2015 USP FYS requirements. These requirements ensure courses meet six "Critical and Creative Thinking student learning outcomes", and that students create a project showcasing the skills students have gained (First-Year Seminar Policies USP 2015, 2016). This study was developed to gain insight on the question of, "*How effective are the bridge vs. regular and Honors FYS classes at developing competencies [of learning objectives] under the University of Wyoming's 2015 USPs?*". As most studies have neglected to look at specific competencies, rather only first year persistence rates—the students that continue to their second year—this study is important for understanding this gap. Students taking FYS were asked to complete a survey—In the beginning and end of the semester—on how competent they believed they already were in the learning objectives. Simple analysis showed a positive relationship between FYS and learning objective competencies overall, but further research is necessary to evaluate differences between Bridge, FYS, and Honors FYS courses.

## **Improving HVAC Performance for Legacy Molding**

Jackson Rambough with Dr. Kevin Kilty

Mechanical Engineering

University of Wyoming

Oral Presentation

*Engineering*

*Laramie, WY*

This Senior Design Project utilizes computer generated models to improve HVAC systems in challenging environments, namely Legacy Molding's headquarters. Plastic and fiberglass molding machines generate high heat loads requiring substantial HVAC systems to produce comfortable work station temperatures. Smaller molding businesses, like Legacy Molding located in Riverton, Wyoming, are commonly housed in relatively small buildings not designed for extreme heat loads, further complicating a possible HVAC solution. By integrating experimental data into a three-dimensional thermodynamic computer model, this report can conclude that Legacy's current HVAC system (or other similar systems) can be improved by repositioning ductwork and molding machinery. However, completely replacing elements of the system is ultimately recommended to ensure reliability and longevity.

## **Design of High Speed Operational Amplifier for Wireless Applications**

Kshama Lakshmi Ranganatha

University of Wyoming

Operational Amplifiers (op amps) are used in many wireless applications. When we consider the transmitter on an FM radio, the filter used includes an op amp and the same applies to the receiver end. Similarly, in faster wireless applications, an op amp is the basic building block of many circuits such as analog to digital converters, etc. For the circuitry to keep up with the speed of the data transferred, the op amp needs to be in par with it. In analog terms, devices that have greater than 50MHz of bandwidth are known as high speed devices. Therefore, a high-speed op amp is required for high speed wireless applications. This senior design project involves the design of a high-speed operational amplifier intended for wireless applications. For a high-speed design, the main parameter taken into consideration is the operating bandwidth of the device. These devices are used in modern-day communication systems such as smartphones, and internet transmitters and receivers. Two op amp topologies that exhibit high speed are, the telescopic cascode design and folded cascode design. Therefore, the design to be implemented involves the investigation of these high speed topologies, including simulation and layout of the high speed amplifiers with tools LTSpice and Electric VLSI.

## Lipidomics and Mass Spectrometric Analysis of Lipids

Karissa Resnik with  
Dr. Franco Basile Chemistry  
University of Wyoming  
Oral and Poster  
Presentation

*INBRE*

*Colorado Springs, CO*

Lipidomics is the study of the structure and function of lipids produced in a cell or organism. These lipids are highly important due to their role in cell signaling, energy storage, and the make-up of biological membranes. The goal of this project was to develop a rapid approach to analyze free fatty acids in biological molecules using mass spectrometry. Mass spectrometry is a technique that makes it possible to detect and identify a large number of lipids. Preliminary data gathered using the technique of Matrix Assisted Laser Desorption Ionization (MALDI) mass spectrometry to analyze complex mixtures of fatty acids proved successful. To ensure that all the molecules present in the mixture were detected, we derivatized the carboxyl group so that the molecule obtained a fixed positive charge. The preliminary data demonstrated that this strategy is viable, and so we propose the utilization of this strategy on biological systems such as bacteria. To do this, bacteria samples (*E. coli* K-12) were grown in the lab. The lipids were then extracted from the bacteria using the modified Bligh and Dyer method of extraction. Once that was completed, the extracted lipids were derivatized and then analyzed using the MALDI mass spectrometry technique.

## The association of intestinal microbiome with severity of *Toxoplasma gondii* infection

Tucker Russell, Amy Rhoad, and Kerry Sondgeroth DVM, PHD,  
DACVM Department of Veterinary Sciences  
University of Wyoming Poster

*Wyoming INBRE*

*Lander, WY*

*Toxoplasma gondii* is one of the most prevalent parasitic infections in humans and animals today (Dubey & Jones, 2000). The intracellular parasite is commonly introduced to hosts by consumption of contaminated material (Dubey, 1998). Consequently, assessing how *T. gondii* affects the gastrointestinal tract may prove useful. As a significant component of the gastrointestinal tract, the microbiome, has contributions to immune response, metabolism, nervous system function, and behavior (Lynch and Pedersen, 2016). Throughout the course of infection the microbiome is often altered and influences the progression of disease (William and Elisabeth de Vos, 2012). Therefore, the purpose of our research is to determine if variation within the host's gastrointestinal microbiome influences severity of *T. gondii* infection. **The current working hypothesis is that variation in the host's intestinal microbiome is associated with severity of *T. gondii* infection.** In this study, an age and gender matched C57/BL6 mouse model was used to assess parasite burden, tissue damage, and microbiome composition throughout the course of infection. Mice were obtained from three different vendors (Jackson, Taconic, and In-House) with the assumption that intestinal microbiomes would differ. To further manipulate microbiome composition, mice were administered antibiotics in their water. Parasite burden in brain, spleen and small intestine was assessed using semi-quantitative polymerase chain reaction testing in acute and chronically infected mice. Preliminary results suggest there is a significant difference in parasite burden of brain tissues from different vendors.

## **Evaluating Dietary Iodine Status**

Sarah R. Rich with Demetre Gostas, Dr. Evan Johnson, and Dr. Enette Larson-Meyer  
Department of Family and Consumer Sciences – Human Nutrition  
University of Wyoming  
Poster Presentation

*INBRE*

*Powell, WY*

Iodine is imperative to the synthesis of thyroid hormones, which are responsible for many functions, including fetal development and cognitive maturation during childhood. Consuming enough iodine is especially imperative to pregnant women and children. Determining the iodine intake for the average US diet has been challenging. This study evaluated the validity of a food frequency questionnaire (FFQ) designed to predict daily iodine intake. This project used data from a separate study – Urine Color as a Marker of a Change in Daily Water Intake – to look at participants with valid FFQs and 24-hour urinary iodine concentrations (UIC) (n=111, men/women=59/52). The calculated averages were, UIC  $147 \pm 131$   $\mu\text{g/day}$  and FFQ  $328 \pm 221$   $\mu\text{g/day}$ . Data showed a correlation between iodine intake and UIC ( $r=0.310$ ,  $p \leq 0.001$ ). Additional analysis using a stepwise multilinear model determined that dairy products were the only significant contributor to iodine status, explaining 15.3% of the variance ( $p \leq 0.0001$ ). Other suspected iodine sources, such as fish, iodized table salt, and multivitamin use, accounted for 2.4% of the variance but were not significant contributors ( $p \leq 0.10$ ). The availability of iodine food composition data has increased in recent years. However, comprehensive values are not available in US food composition databases, preventing concrete identification of major dietary iodine contributors. This study allowed us to determine a correlation between an FFQ and UIC.

## **CdSe Quantum Dots Doped with Rare-Earth Elements**

Sarah R. Rich with Dr. Brian Leonard  
Chemistry Department  
University of Wyoming  
Oral and Poster Presentation

*WRSP*

*Powell, WY*

Quantum dots (QDs) are semiconducting materials that are typically between one and ten nanometers. These particles are capable of quantum confinement which allows for precise control over their band gap and subsequent properties. This tunability gives rise to many potential applications such as solar panels, light emitting diodes (LEDs), and medical imaging. QDs can be further tuned by inserting impurities or dopants into their structures. These dopants can alter magnetic, optical, and electronic properties giving enhanced properties over traditional quantum dots. Cadmium selenide (CdSe) is a well-known II-VI semiconducting material whose available literature is quite vast however the ability to dope CdSe with rare-earth elements is very limited. This research project investigated a new synthetic approach aiming to dope CdSe with different rare-earth elements. By studying both crystal structures of CdSe, hexagonal (wurtzite) and cubic (zinc blende), we were able to monitor the doping efficiency changes in relation to the crystal structure. Several different concentrations were used for each element to help determine the maximum dopant concentration. Several different analytical techniques were used, including transmission electron microscopy (TEM), scanning electron microscopy (SEM), inductively coupled plasma mass spectrometry (ICP-MS), ultra-violet spectroscopy and x-ray diffraction (XRD). Each analytical technique provided information necessary to conclusively determine the amount of rare-earth elements doped into the CdSe nanoparticles.

## **Analyzing the Effects of Voter Identification Laws**

John Richardson

Political Science

University of Wyoming Oral Presentation

*Honors*

*Green River, WY*

This paper presents a synthesis of background information, major studies, and court cases related to voter identification laws and their impacts on voter turnout in states across the United States. There is a veritable wealth of information regarding this topic, and the state of these laws and their impacts vary widely from decade to decade. The purpose of this project was to present an amalgam of the available research and to draw conclusions from that effort. In doing so, it is clear that as of the completion of this project, strict voter identification laws are directly responsible for lower turnout among voters that identify with and vote for the Democratic Party. This paper also examined the effects of voter identification laws on individuals that traditionally vote for the Republican Party and provided some cursory conclusions about the effects of these laws on those individuals in the years to come.

## **Synthesis of Hydrogel Microparticles through Microfluidic Devices for use in Drug Delivery**

Savanah Richter with Dr. Katie Dongmei Li-Oakey

Chemical Engineering

University of Wyoming

Oral Presentation

*INBRE*

*Pine Haven, WY*

Current passage ways for drug delivery, such as the oral and bolus routes, have major drawbacks (Gao and Li 2013). One problem is the rapid decrease in drug concentration with current methods of drug delivery (Bjornmalm, Yan and Caruso 2014). Also, adverse side effects occur due to healthy cells being targeted from non-specific localization of treatment (Gao and Li 2013). Our current research is designed to address these problems. In previous work we have designed hydrogel microparticles that encapsulate florescent proteins using the polymer PEGPLA from microfluidic devices. These microparticles were monitored for protein release profiles based on the size and weight of the protein. My part of this process is to help fabricate the microfluidic devices using replica molding. Microfluidic devices are used as they can create monodisperse droplets as small as 10 microns. The next aim of the project is to conjugate targeted anti-cancer drug Herceptin in microparticles and perform in vitro studies with breast cancer cells. We are exploring different methods to perform the in vitro studies. The long-term goal of the research project is to make hydrogel microparticles that have encapsulated chemotherapy drugs in the shape of red blood cells with signaling molecules to bond to cancer cell surface receptors. The red blood cell shape is useful for the delivery of the drug through small capillaries in the body. With this work, we aim to reduce the issues with current drug delivery pathways.

**Living With Plastic**  
Anthony Rivers  
University of Wyoming  
Oral Presentation

*Engineering College, Haub School, Engineers Without Borders*

What possible uses can be applied to the astonishing amount of plastic waste generated daily, in such a way as to be sustainable and economically viable? Is it possible to create or innovate a material for use in engineering applications, such as concrete? Everybody now knows about the Great Pacific Garbage Patch, but the problem is now so pervasive that plastic particles are even contaminating up to 90% of all table salt (Ji-Su Kim, et al., Environ. Sci. Technol. 2018, 52 (21), 12819-12828. DOI: 10.1021/acs.est.8b04180). I want to conduct research and, hopefully, experimentation, on engineering uses we may find for plastic waste that is generated by every single aspect of human life throughout the world. With specific focus on items like plastic bottles and packaging, to conglomerate plastic refuse that could be collected from marine environments or removed from waste processing circulation; plastic may be incorporated into insulation materials, or reduced or combined into different forms to function as aggregate materials for products such as special purpose concrete or filler. If plastic waste could be successfully implemented as a useful material, the raw constituent would not need to be imported from anywhere, since it is readily available everywhere. Not only would it reduce waste volume in both landfills and unintended depositories, i.e. the ocean, but its abundance and availability could reduce carbon footprints in trucking or shipping, as well as quarrying operations whose product is aggregate material. It could reduce costs of building materials while simultaneously creating a plastic “market”, and other subsequent economic benefits.

**3D Printing and the Oil and Gas Industry**

Chelby Rush, Marc Miguel Siani, Bryce Robert, Dakota Schroeder, Hairi  
Ting with Dr Tawfik Elshehabi  
Petroleum Engineering  
Department University of  
Wyoming  
Oral Presentation

*Undergraduate Research Day*

*Laramie, WY*

The future is here. 3D printing has made a great impact on many different fields. From toy design to great medical advices, we are living in the future. This great technology has yet to make its grand appearance into the oil and gas industry, but we are hoping to change that. The objective of this 3D Delta Drilling Design team was to gain a greater understanding of how 3D printing could affect the oil and gas industry. First, the group gained a better understanding of how 3D printing works. This was done by creating a 2-foot-tall drilling rig replica. The project includes the main components onsite for a drilling rig. The team then did extensive research on metal 3D printing. This was used for a cost analysis comparing different, commonly broken, equipment on oil rigs to see if 3D printing could save companies money and time versus having to order and ship the part. The team will also discuss the future of 3D printing and the oil and gas industry in the next 5, 10, and 20 years.

## **Does the composition of the intestinal microbiome affect the severity of Toxoplasmosis infection?**

Rachel Shrode and Susannah Roberts with Kerry Sondgeroth DVM, Ph.D  
Department of Veterinary Sciences  
University of Wyoming  
Poster

INBRE

*Waunakee, WI & Lakewood, CO*

*Toxoplasma gondii* (*T. gondii*) is a parasite that infects one-third of the world's population. It causes the disease Toxoplasmosis and is considered to be the leading cause of death attributed to food borne illness. Limited studies have evaluated the relationship between the human intestinal microbiome and severity of *T. gondii* infection. Thus, understanding this interaction may lead to microbiome manipulations that reduce the frequency and/or severity of Toxoplasmosis. **We hypothesized that the intestinal microbiome is altered when the host is infected by *T. gondii*, and that these changes are associated with disease severity.** To test this hypothesis, C57/BL6 mice from three suppliers were utilized to assess the severity of intestinal damage, parasite load during acute and chronic infection, and the composition of the intestinal microbiome present during infection. Since mice from the same genetic background coming from different suppliers may respond differently to infection, cohorts of mice were compared between suppliers to determine if the differences were significant. Further, broad-spectrum antibiotics were administered to compare disease severity in the presence and absence of the bacterial microbiome. Using the QIIME2 bioinformatics pipeline, intestinal microbial composition comparisons, statistical significances, and interpretations of visual changes through the evaluation of alpha and beta diversity were investigated. The preliminary, results indicate a significant difference in beta diversity between suppliers at each time point. A difference in alpha diversity was observed between acute and chronically infected mice between two suppliers.

## **Aubade: Beauty, Death, and Jealousy in the Vampire Narrative**

Anna Rose with Dr. Erin Abraham  
Honors College  
University of Wyoming  
Oral Session

*Honors College*

*Laramie, WY*

Rosalie Hale, a vampire, has spent nearly a century alone, a paragon of beauty who wants nothing more than to age and die. When the intriguing Isabella Swan walks into Rosalie's undeath, Rosalie plunges into a romance that threatens her secret existence as a vampire and threatens Bella's life. Rosalie will have to make a choice: letting Bella live out the life Rosalie wanted, transforming Bella into a vampire to live a beautiful undeath together, or killing Bella—and ending her temptation forever. The purpose of writing this story was to explore the themes of beauty, death, and jealousy present in the traditional vampire narrative. Rather than using a traditional narrative, this work is a work of Twilight-based fanfiction. By using the fanfiction format, the story can explore new themes using a familiar setting and familiar characters. This setting and these characters had the latent potential to explore these themes, but the original author chose to focus on other themes and a different narrative. Through fanfiction, this new story can be effectively explored.

## **Telehealth as a Method for Increasing Access to Specialized Medical Care for Wyoming Residents**

Dylan Rust, Mentored by Pamela J Langer, PhD  
University of Wyoming  
Oral

*Honors College*

*Green River, WY*

Individuals in Wyoming often have to travel hundreds of miles to receive specialized types of care, such as cardiology, neurology, specialized surgeries, etc. Travel is difficult for patients as it costs money, takes time, and if the person is unable to drive, they cannot access needed care. Telehealth is a booming new industry that is being used to provide various levels of care, and has been shown to be successful in many instances. However, it seems that Wyoming has not embraced this new method of providing care, nor have physicians who provide specialized care. Pilot studies around the country and globe have demonstrated the feasibility and accuracy of telehealth in providing care to patients in a variety of medical specialties. Economic analysis of telehealth networks suggest monetary benefits to patients, physicians, and the hospitals they work for. Patients and physicians who participate in telehealth services report feeling that excellent care was provided, and a vast majority said they would use telehealth again for providing or receiving healthcare. For these reasons, physicians and patients in Wyoming should look to telehealth for medical services that are not offered locally or within the state. This method of care will benefit patients and physicians financially, and increase access to necessary care for Wyoming residents.

## **Algal Growth Under Vertical and Horizontal Confinement Using Microfluidic Devices**

Benjamin A. Sabat<sup>1</sup>, Dr. John Oakey<sup>1</sup>

<sup>1</sup>Department of Chemical Engineering, University of Wyoming  
INBRE Poster Presentation

*INBRE*

*Laramie, WY*

Microfluidics describes the technological application of manipulating fluids within extremely small channels. Microfluidic devices have a wide array of uses and are commonly fabricated using inexpensive molding in polydimethylsiloxane (PDMS), which allows for gas permeability and is biocompatible, creating a favorable environment for the growth and movement of microorganisms. Microfluidic devices also allow for the spatial properties, such as the depth and width of growth environment to be precisely altered. Here, these devices are growth chambers used to obtain high-resolution images of growth rates and distribution of single-celled alga. Microfluidic growth chambers allow for cells to be grown in a single plane, defined by the depth of the chamber, allowing for a three-dimensional cell to be easily imaged. We created microfluidic devices to study the growth dynamics and motility of a desiccation-tolerant green algae found in desert soil crusts. The motility and growth dynamics of this algae have not been previously studied because they are conventionally grown in a suspension. This alga was studied in the confined environment of a microfluidic growth chamber, designed to represent basic aspects of their native soil niche, and were found to exhibit a “passive motility”, seeming to explore its surrounding environment. Here, we are seeing how algae reacts in both growth rate and dispersion when confined horizontally and vertically in these growth chambers, and how the seeding density effects the dispersion and growth rates in devices of increasing depth.

## Understanding Binding Promiscuity in an Intrinsically Disordered Protein

Kaylan Schilling<sup>1</sup> and Dr. Grant Bowman<sup>1</sup>

<sup>1</sup>Department of Molecular Biology

University of Wyoming

Oral and Poster

*INBRE*

*Riverton, WY*

Despite being the simplest and smallest forms of life, bacteria exhibit a surprising degree of subcellular organization. In the cytoplasm, large and complex features are formed as individual proteins collide, interact, and assemble into interconnected macromolecular structures. In *Alphaproteobacteria*, Polar organizing protein Z (PopZ) self assembles into a highly dynamic scaffolding network at the cell poles. PopZ has an intrinsically disordered N-terminal domain, which forms a flexible binding site that interacts with at least eight different proteins involved in cell cycle regulation and chromosomal segregation. We have identified a critical element within the N-terminal binding domain of PopZ. It is a short, evolutionarily conserved sequence that forms a temporary alpha helical structure upon contact with a binding partner and may also be the primary determinant for binding specificity. We are comparing distantly related organisms, such as *Caulobacter crescentus* and *Rickettsia rickettsii*, and asking if the differences in this short amino acid sequence dictate changes in binding partner specificity. To do this, we create chimeric constructs that specifically highlight different sequences within the N-terminal binding domain. Binding activity is assessed by co-expressing fluorescently tagged chimeric PopZ variants with GFP tagged binding partners and observing the degree of co-localization by live-cell fluorescent microscopy. Our preliminary results provide indications of structural determinants that are essential for PopZ's broad binding specificity and also provide insight into how intrinsically disordered proteins change over evolutionary time.

## Efficient Living: Exploring the Possibility of Replacing Insulin Therapy for Type I Diabetics

Carissa A. Schmidt and Eric C. Atkinson

Biology Department, Northwest College

Poster

*Northwest College*

*Powell, WY*

Are there specific effects from exercise on symptoms of disease? This study explores the effects of exercise on the control of blood glucose. The body is the most efficient machine out there. It is designed to repair itself when it has been damaged. I wanted to know if it is realistically possible to use the body like machine and eliminate the use of Insulin for Type I Diabetics. What role does exercise play in restoring a diabetic's body to full potential? When genetic mutations emerge, I hypothesize that exercise plays a significant role in controlling or reversing symptoms. A few of these effects can be observed when looking at the role exercise plays in control of blood glucose. In the following study I observed blood glucose levels of active individuals, before and after exercises, for 2 weeks. I measured blood glucose levels in six individuals 10-15 minutes, 30-45 minutes, and 60-120 minutes following bouts of three exercise types (cardio, strength, and a combination of the two). The recorded blood glucose levels were strongly influenced by exercise type at 10-15 minutes ( $F_{4,51} = 5.444$ ,  $p < 0.001$ ) and at 30-45 minutes ( $F_{4,52} = 5.257$ ,  $p < 0.001$ ). No significant effect was shown after 2 hours. Blood glucose levels following strength training were significantly higher than cardio and cardio/strength at both 10-15 minutes and 30-45 minutes following exercise bouts. After the analysis of collected data, exercise appears to have a significant impact on glucose control in the body.

**The Effects of Accounting for Uncertain Dynamic Soil Properties on the Design Response Spectrum for Different Soil Types.**

Gerald Schmidt with Shawn Griffiths and Josh Frazier

Civil Engineering

University of Wyoming

Poster Presentation

*Civil Engineering*

*Peotone, IL*

Seismic site response analyses can be categorized as an advanced analysis and are a useful tool for predicting design accelerations at the ground surface. Current AASHTO guide specifications recommend accounting for uncertainties when performing seismic site response analyses. Accounting for the many uncertainties the factors below are investigated for an accurate ground representation:

- 1) Different analysis types (i.e. equivalent linear vs non-linear ect...)
- 2) Input ground motions
- 3) Different shear wave velocity models
- 4) Uncertainties associated with the dynamic soil properties

Currently there are few recommendations about how to best combine these many results into a single useful response spectra. This research investigates the uncertainties associated with the dynamic soil properties for three different hypothetical sites, each primarily made up of sand clay or gravel, respectively. The dynamic soil properties are varied using plus and minus one standard deviation in a fully coupled manner. Recommendations concerning which soil types produce the largest variation in predicted response spectra, and hence what soil types may be most sensitive when accounting for uncertainties in dynamic soil properties are made. Comparisons between the predicted response spectra determined by varying the dynamic soil properties are compared with the predicted response determined from varying the shear wave velocity. In consequence of the presented analyses the authors postulate the necessity of varying the dynamic properties in addition to varying the shear wave velocity profile, as these two variables are both related to the computed small strain modulus and varying both may be overly-conservative, or unnecessarily redundant.

**There Is No “I” In Trans\***

Luke Schmidt with Arielle Zibrak

English

University of Wyoming

Poster Presentation

*Honors*

*Cheyenne, WY*

The conventional subgenres of autobiography, such as a slave or immigrant narrative, are based on a static form of identity. The construction of a trans\* subgenre of autobiography is not possible under the same notion of stability, the trans\* identity is pluralistic and in constant fluctuation. In my thesis, I will be examining how current concepts of trans\* life writing forces out the expected “I” format of the autobiographical genre, adding in the necessity for a “we” tone of advocacy in the face of social trans\* issues, explored in Janet Mock’s autobiographies *Redefining Realness* (2014) and *Surpassing Certainty* (2017). While the trans\* narrative doesn’t allow for an isolated “I” tone of self, trans\* life writing can benefit from the filter of a third party of an individual, as seen in Maggie Nelson’s *The Argonauts* (2015), where trans\* issues can be talked about in relation to an individual, rather than the speaking for an entire community.

## **Tissue Culture with Meristematic Tissue of *V. vinifera***

Heidi Schueler and Alisha Bretzman with Ami Erickson Agriculture Department  
Sheridan College  
Poster

### ***INBRE***

Tissue culture is the process of asexually propagating plants in an in vitro setting. An in vitro setting provides a controlled growth environment for an explant and limits disease. In vitro propagation is known for its ability to produce vigorous clones of fruit plants like *V. vinifera* (grape). The goal of this project is to micropropagate apical meristematic tissue from *V. vinifera*. Meristematic tissue is the undifferentiated plant cells responsible for cell division. By using meristematic tissue the rate of cell division is increased while decreasing the susceptibility of disease in the explant. The micropropagation of apical meristematic tissue begins with removal of the apical meristem of a vigorous *V. vinifera*. The apical bud was removed from the *V. vinifera* stem, disinfected in a three step process using ethanol, bleach and a water bath. Next the meristematic tissue was placed in C2D4B media, containing all necessary elements for cell division. After a two week period the explant underwent organogenesis and produced callus tissue. Callus culture produces cells that can instantly undergo embryogenesis and repropagate. Propagated *V. vinifera* shoots were taken from the plant and placed in petri dish with C2D4B media. When *V. vinifera* explants produced hardy roots they were transplanted into soil.

## **Precursor Systems to Red Novae**

Alexander Schultz with Henry Kobulnicky  
Astronomy and Astrophysics  
University of Wyoming  
Poster Presentation

*NASA Space Grant Program*

*Aurora, CO*

The evolution of close binary systems and the formation of contact binary stars has been a focus of spectroscopic astronomers for over two decades. Kulkarni et al. (2007) coined the term Red Nova to describe the dramatic brightening that occurs after merging of a contact binary system. My project focused on finding evidence on prospective theories behind how Red Novae occur, specifically the theory that a tertiary star would be necessary for any contact binary system to form. Instrumentation at the Apache Point Observatory was used to collect spectra of known contact binary systems, in hopes of finding evidence of a tertiary star in orbit of the binary systems. In the future, a second round of observational spectra will be necessary to conclusively provide evidence for or against the existence of tertiary stars in orbit of the selected contact binary systems. I will present spectra from the Apache Point Observatory of 10 contact binary systems which allows us to measure the masses of possible progenitors to luminous Red Nova.

## **ICCE Microbiology: Can Microorganisms Indicate Prehistoric Human Presence or Specific Alpine Activities in the Wind River Mountains?**

Brayden Wirick & Lucas Schwandt  
Central Wyoming College

During the 2018 CWC archaeology students participating in the Interdisciplinary Climate Change Expedition (ICCE) collected soil samples from known and suspected prehistoric lodge pads at three sites above 10,500ft in the Wind River Mountains. The purpose was to test for microorganisms that could indicate the presence of prehistoric humans or even identify specific activity areas within lodges. This technique has been utilized with some success in Sicily, but students wondered if it could be accomplished by undergraduates working at elevation? If so, this technique could be used elsewhere to verify whether or not suspected high elevation features are in fact lodge pads without having to undertake costly and destructive subsurface excavations in the fragile alpine soils.

## **Adsorption of Arsenic Oxides by Cupric Oxide Nanowires**

William "Buck" Scougale, Teyu Chien  
Physics & Astronomy  
University of Wyoming  
Oral and Poster Presentation

*Physics & Astronomy, and Honors*

*Laramie, WY*

A novel synthesis of cupric oxide nanowires is developed then the resulting nanowires are tested to adsorption of arsenic oxides from water. Arsenic oxides contaminate groundwater around the world and current removal processes are either expensive or ineffective. Many metals and metal oxides, including cupric oxide, have been studied for adsorption of arsenic oxides. Cupric oxide nanoparticles have been shown effective at adsorbing arsenic oxides in a variety of conditions and in the presence of competing anions. Additionally, previous studies have shown that under controlled atmosphere, cupric oxide nanowires can be grown by direct oxidation. In this study, cupric oxide nanowires are grown by direct open air oxidation and are characterized using XRD, SEM and RAMAN spectroscopy. The samples are then tested by batch analysis for adsorption of arsenic oxides from water. A concentration range of arsenic oxides approximately what is found in the Rocky Mountain Region is analyzed to provide insight to the merit of future study.

**Assessing the role of native fruiting plant habitat type on invasive bird visitation patterns on Oahu, Hawaii**

Nicole Sederstrom, Rebecca Wilcox, Corey Tarwater  
Ecology  
University of Wyoming  
Poster

*Ecology*

*Goodland, KS*

Seed dispersal is the movement of a seed away from the parent plant and is critical for maintaining plant communities and habitat structure. In plants that require animals for seed dispersal, spatial mismatching between disperser habitat selection and plant habitat occupancy might lead to low plant-animal interactions. Spatial matches may be particularly important in systems with only invasive dispersers. In these systems, the dispersers do not specialize on certain plants and often more dispersers means more fruits consumed. Using the island of Oahu, Hawaii, where only invasive dispersers remain, we asked the following question: does the dispersal species, disperser diversity, and disperser richness change for plant species that occupy different habitat types? We utilized a fruiting camera dataset of 22 native plant species. We performed a literature search to describe habitat types (topographic position, slope, and canopy cover) occupied by each plant. Shannon's Diversity Index was calculated to assess diversity of visitor species in relation to each habitat type. Variation in species richness (range=3-5) and Shannon's Diversity Index (range=0.31-0.46) did not vary across habitat types. However, specific disperser species patterns did emerge. Japanese white-eye were generally found more in habitats with mid-high canopy cover and on steep slopes. While red-billed leothrix were generally found across all habitat types. While visitor richness did not vary, species specific patterns suggest that spatial mismatches between specific plant-disperser pairs could be important. Future studies should continue to explore the potential of spatial mismatches limiting seed dispersal in novel ecosystems.

**Reserved Inequality: A Study of Inequality on the Wind River Reservation**

MacKenzie Sewell  
University of Wyoming

This project is an historical analysis of inequality of the Native Americans in Wyoming. Specifically, it examines the historical roots and implications of various facets of inequality among the Northern Arapahoe and Eastern Shoshone tribes on the Wind River Reservation near Riverton, WY. From the establishment of this reservation through approximately 2010, this project looks at educational disparities, housing, as well as economic inequalities surrounding employment, income and wages, and poverty. As this project clarifies, all of these fields present significant inequalities for the members of these tribes, and each has historical roots that persist to today.

## **Linear Invariants of Graph Laplacians**

Emily Shaw with Dr. Farhad Jafari  
Department of Mathematics and Statistics  
University of Wyoming  
Oral Presentation

*Honors Program*

*Reston, VA*

Graph theory is the area of mathematics where we study a set of points (vertices) and connections (edges) between these vertices. Many problems can be recast in this language. We can associate matrices to graphs in various ways (incidence matrices and adjacency matrices) that allow one to reconstruct the graph based on these matrices. In graph theory we work with these matrices to determine particular properties of the graph. The graph Laplacian is a useful tool that captures some of the graph properties. In this talk, we ask what are the linear transformations that preserve the graph Laplacian. This question establishes an equivalence relation on the set graphs that have the same graph Laplacian. We obtain a complete answer to this question.

## **Extreme Makeover: BERG Edition**

Slade Gregory Sheaffer,  
UW BERG (Building Energy Research Group)

The DeVries Guest Lodge is part of a small compound on the DeVries family ranch outside of Evanston, Wyoming. The property consists of two small cabins and two barns, as well as the guest lodge, which is presently both functionally and aesthetically outdated. Working with the University of Wyoming's Building Energy Research Group (BERG), this project was intended to transform the DeVries Guest Lodge into a modern, functional, and energy-efficient facility for use by the DeVries family and guests. Design of the remodel used energy analysis to measure efficiency benefits of the remodel, as well as virtual reality to make conscious and effective changes to the architecture of the space. The final product will be a more aesthetically fitting piece of the DeVries family ranch. Construction of the redesign will commence in the Summer of 2019.

## **Regression vs. ANOVA: Which to Choose?**

Josh Sheinberg with Stephen Bieber  
Department of Statistics  
University of Wyoming  
Oral Presentation

*Honors College, McNair*

*Broomfield, CO*

We explore the differences between two common statistical methods (Regression and Analysis of Variance) on predicting average household adjusted income across 50 states in 2015. These two methods will be compared in two different settings, each using two predictor variables; one with a significant interaction present between the two predictors and one without a significant interaction. These methods are compared from the context of the research question being considered, the statistical results, the graphical results, and the resultant answer (interpretation of the statistical and graphical results). In the end, we find that neither model is objectively better than the other. We do find, however, that the added complexity of Regression models does not always result in an answer that differs from the simpler AOV model when there is no interaction present. With an interaction, we find that AOV does not always tell the whole story.

## **Geochemical Analysis of Fossil Shells from *Sokolowia buhsii* (Order Bivalvia) as a Proxy for Late Eocene Paleoenvironmental Reconstruction in the Tajik Basin, Tajikistan**

Garrett Shepherd with Dr. Mark T. Clementz  
Department of Geology & Geophysics  
University of Wyoming  
Poster Presentation

*McNair Scholars and Honors*

*Tulsa, OK*

This study will use stable isotope and trace element ratios from the growth increments of fossil bivalves to determine the relationship of two Central Asian basins during the late Eocene Epoch (~40 Mya). The Tajik and Tarim Basins of Central Asia were once connected as part of the ancient Paratethys Seaway, but have since been disconnected by the northward progression of the Pamir Mountains. I hypothesize that the basins' connection was severed before the end of the Eocene. Fossilized oysters belonging to the species *Sokolowia buhsii* have been collected from the Tajik Basin and dated to be late Eocene in age. A rock saw will be used to create thin sections of the shells perpendicular to the growth increments at each specimen's hingeline. Material from each growth increment will be powdered using a small, computer-guided drill bit. Material will then be collected and weighed for analysis using a mass spectrometer to determine the ratios of stable oxygen ( $\delta^{18}\text{O}$ ) and magnesium to calcium (Mg/Ca). Results of this study will be compared to a similar study conducted in the Tarim Basin. Analysis of the two data sets will determine the relationship of the basins during the late Eocene. This study is designed to test the validity of climate models, and also establish a unified timeline for the retreat of the Paratethys Seaway. Results from this study will lead to a better understanding of the geologic history of Central Asian climate, as well as further solidify sclerochemical methods as a useful proxy for paleoclimate.

**Swimmer Emergency Assistant Device**  
Kathleen Shuster with Dr. Cameron Wright  
Department of Electrical and Computer Engineering  
University of Wyoming  
Oral and Poster Presentation

*Electrical and Computer Engineering*

*Kent, WA*

To develop a small buoy that is dragged behind a swimmer that measures heartrate and oxygen levels of the swimmer and manual input response of the swimmer. When the emergency response is activated the buoy reels itself to the swimmer, inflates an emergency inflatable to keep the swimmer above water, and activates an audio-visual alarm system. For use in lakes where life guards may be too far away to assist in an emergency situation so that both the swimmer and life guard have additional time in an emergency. The expected results are an emergency response that can be activated through biometric or manual response and a response time of less than 15 seconds to complete all actions.

**Bridging the Gap We Imagined: Deconstructing Human/Non-Human Binaries in  
Science Fiction Film**

Wayne Sides with Dr. Patrick Konesko  
English  
University of Wyoming  
Oral Presentation

Since *Frankenstein* (1931) and through *Blade Runner: 2049* (2017), cinema has found a form of expression and success through the science fiction genre. By introducing its audiences to a form of “cognitive estrangement” (Suvin), science fiction forces consumers to re-evaluate themselves and reflect on who they are; what they are. It “has simply proven to be one of our most flexible popular genres” (Tellote) because it can *become* any situation and still reflect our own. While incorporating aspects of the marvelous, fantastic, and uncanny (Todorov), we are able to imagine the supernatural or spiritual “as it intrudes into and challenges our everyday world” (Tellote). But these forces acting in opposition to our society reveal deeper truths central to mankind’s position and self-image: those of insecurity, unease, and play through methods developed by the theorist Jacques Derrida. Through Derrida’s theories on Structure and Deconstruction, it is possible to analyze science fiction film in an attempt to uncover why humans always position ourselves opposite to these mysterious, “uncanny,” never-human forces. Why are we obsessed with not being them when they are always almost human and even sometimes post-human? Analyzing the structure of human/non-human relationships in science fiction can help to reveal our own anxieties regarding existence, especially as we approach a future that seems more and more like science fact than science fiction. After all, what better way to question “who we are and what is life all about” (Bywater, Subchack) than through a genre founded by questioning “what if” in our own futures?

## **Land Grabbing's Role in Latin American Inequality**

Caitlyn Skavdahl with Dr. Yi-Ling Chen

International Studies

University of Wyoming

Oral Presentation

*Honors*

*Casper, WY*

Land grabbing is an increasingly problematic occurrence in the developing world, especially in Latin America. This act of purchasing large amounts of land, either by the state or by transnational corporations has seemingly led to growing inequality among indigenous and afro-descendant populations, especially in countries such as Argentina and Brazil. While this action has allowed for perceived economic development, the fact that land grabbing simultaneously hurts and helps indigenous and afro-descendant populations is sometimes ignored due to the increasing prevalence of land-grabbing on smaller scales. Cases, such as that of “Terra Legal” problem in Brazil, help to highlight this issue (Oliveira, 2013). Through this research paper and project, I hope to better understand what role land-grabbing has on the inequalities present for indigenous and afro-descendent populations in Latin America. It is also my desire to investigate why this act of land-grabbing can lead to inequality through natural resource extraction and forced migration among these same populations.

## **Off-Grid DC Renewable Energy Simulator**

Alex Skorcz, Casey Smith, James Toomey

Professor Lawrence Willey

University of Wyoming

Oral Presentation

*Department of Mechanical Engineering*

*Laramie, WY*

A teaching tool that provides real-world data was desired to aid in the teaching of mechanical engineering courses that focus on solar and wind energy. This renewable energy system consists of a 400-Watt wind turbine, two 100-Watt solar panels, and a 12V 400Ah battery system, and a remote data collection system. The system is being put into place on the roof of the Energy Innovation Center, located on the north side of University of Wyoming campus. This system will be able to simulate the power required in an off-grid RV or cabin. The turbine had been previously selected by the project advisor for the specific intentions of this application, and a mast was designed, constructed, and erected by the team. The solar panels were sized to make up the power difference between the desired system output and the turbine output, an adjustable mounting rack was then designed and built by the team to maximize energy production throughout the year. All the output voltages will be recorded using an Arduino that will collect the data. With this system in place the data collected will be usable for the applicable courses and give real-world examples and applications for learning and teaching.

## **Understanding Binding Specificity of Polar Organizing Protein Z**

Sarah Steinberg and Theresa Smith with Dr. Motriuk-Smith and Dr. Bowman  
Department of Zoology and Physiology and Department of Molecular Biology  
University of Wyoming  
Poster Presentation

*INBRE*

*El Cajon, CA  
Monticello, MN*

*Caulobacter crescentus* is an oligotrophic bacteria in the class of Alphaproteobacteria. It is known to express an intrinsically disordered protein, Polar Organizing Protein Z (PopZ). PopZ is responsible for cell organization and polar localization during asymmetric cell division of *C. crescentus*. The interactions between PopZ and a specific binding partner can be observed by expression of recombinant DNA in *Escherichia coli*. Isopropyl  $\beta$ -D-1-thiogalactopyranoside (IPTG) induces expression of mCherry fused with PopZ. Induction with Arabinose results in expression of green fluorescent protein (GFP) fused with any of the binding partners. Therefore, the interactions between binding partners and PopZ can be observed using fluorescent microscopy. Previous studies have optimized experimental conditions of positive control expression, using ChpT and ParB, which co-localize with wild type PopZ. This study includes screening interactions of PopZ mutants that have either been altered at the N-terminus or the PED regions, with proteins involved in cell division.

## **Validation of a Novel Molecular Assay for Swine Brucellosis**

Meagan Soehn<sup>1</sup>, Dr. Brant Schumaker,<sup>1</sup>

<sup>1</sup>Department of Veterinary Sciences, University of Wyoming  
Oral Presentation

*Casper, WY*

Brucellosis is a zoonotic bacterial disease that has around half a million new cases each year worldwide. Swine brucellosis is caused by *B. suis* and is endemic in feral swine populations. Overlaps between feral swine and domestic swine, cattle, or humans can lead to further transmission of the disease. This poses health risks to these populations as well as harm to the swine and cattle industries. In the 1950's NASA developed the Hazard Analysis and Critical Control Point (HACCP) system to propagate advancements on food safety. One crucial component of this system is the ability is to detect the presence of any food pathogens in packaged food. This provides safety for the everyday consumer, and also for crew members of space expeditions. Current diagnostic tests are unable to differentiate between *B. suis* and the cattle form of *B. abortus*. Additionally, cross reactions with other bacteria can produce false positives test results. The current gold standard is to culture the bacterium for testing, but this process is lengthy, expensive, requires the animal to be euthanized and puts laboratory workers at a risk of exposure. This project aims to validate a new diagnostic quantitative polymerase chain reaction (qPCR) as a faster, cheaper, tool to identify *B. suis* that can also potentially be done with ante-mortem samples. Our results showed that our qPCR test had moderate to good agreement when compared to current diagnostic tests, including perfect sensitivity when compared to culture. Only half of our qPCR positive hogs had a positive sample that was antemortem, indicating a need for further development of this aspect of our assay.

## **Applications of Supervised Classification and Field Ground Truthing to Identify Cheatgrass Population Densities**

Mark Star and Sarah Wempen with Michele Mattix and Jacki Klancher  
Alpine Science Institute - Central Wyoming College  
Poster Presentation

*Lander BLM Field Office*

*Lander, WY*

*Bromus tectorum*, commonly known as downy brome or cheatgrass, is a winter annual grass invasive to the sagebrush steppe of Wyoming and the surrounding Intermountain West. Early-season growth patterns and extended-seed viability lead to a rapid reduction of native species and an increase in fire frequency. The identification and classification of cheatgrass population densities are critical to ensuring the health and productivity of our public lands. The Bureau of Land Management's (BLM) Lander field office recorded a series of multi-spectral 15 cm resolution aerial images during the peak of seed head formation. Cheatgrass flowers in the late spring before most other vegetation, which allows for identification of the purplish seed heads using remote sensing. Training samples for the varied cover types and cheatgrass densities were created using BLM land-cover percentage guidelines, visual identifiers, and actual step-point observations. Each area of interest (AOI) was classified using the supervised classification tool within ArcGIS and the results were compared to randomly selected ground truths. Histograms and scatter point plots of misidentified areas were analyzed for unique spectrum qualities and training samples were modified to account for inconsistencies and misidentifications. Reddish colored soils of the Southeast Shoshone Road AOI were regularly misidentified as cheatgrass, ultimately necessitating the creation of training samples based on their unique infrared spectrum characteristics. The product was a series of low-resolution choropleth maps representing land-cover percentages of low, medium and high-density cheatgrass populations. The end result can help facilitate a targeted approach to cheatgrass remediation efforts.

## **The Role of Social Eating in the Relationship between Appearance Orientation and Eating Disorder Related Impairment**

Zoe Stone with Dr. Kyle De Young  
Department of Psychology  
University of Wyoming  
Oral and Poster Presentation

*Honors*

*Thermopolis, WY*

Fear of negative evaluation from family, friends, and/or peers can lead to fear or avoidance of eating with others (Spoor et al., 2006; Petrie et al., 2009). These fears and behaviors can lead to impairment in multiple circles of one's life (Aderka et al., 2014). The fear of negative evaluation has been shown to be a predictor of disordered eating, thus the present study attempted to analyze the effect of social eating on impairment (Levinson & Rodebaugh, 2011). Fear of negative evaluation Research has previously found a relationship between appearance orientation (AO) and eating disorder (ED) related impairment. The purpose of this study was to test the determine if the association between AO and ED related impairment is mediated by the avoidance of social eating (ASE). Participants ( $N = 303$ ) completed measures assessing eating psychopathology, ED related impairment, and AO. Data from a cross-sectional survey were analyzed using the PROCESS macro (Hayes, 2017) in SPSS. Results indicate statistically significant pathways between all three variables (AO-ED-impairment; AO-ASE; ASE-ED-impairment) as well as statistically significant partial mediation (indirect effect = 0.0990, CI (95%) = 0.0488, 0.1452) when controlling for both sex and BMI.

## **The Damascus Affair and Antisemitism**

Holly Stooksbury with Dr. Seth Ward

Modern Middle East

University of Wyoming

Oral Presentation

*Department of Religious Studies*

*Fort Collins, CO*

Antisemitism is a significant example of how prejudice evolves over time. The 19<sup>th</sup> century was a critical time in the evolution of antisemitism because important ideas came about that would help shape future events such as the Holocaust in Europe. It was a time of developing stereotypes such as the Jews being all-consumed by money and that the Jews were of an inferior Semitic race. However, the 19<sup>th</sup> century would also add to those stereotypes with the Damascus Affair in 1840. This incident, which started out as an incident contained to the city of Damascus quickly turned into an international incident that greatly affected the Jews in Europe and parts of the Middle East. This presentation will look at what took place in Damascus during this time, the people involved in these events, and how these events quickly spread to parts of Europe and other parts of the Middle East while paying close attention to how these events lead to the development of more antisemitic beliefs that would eventually help shape future events of this form of bigotry. The goal of this presentation is to show how popular opinion can be a determining factor in the course of history and to illustrate how certain popular opinions determined the course of the events related to the Damascus Affair and beyond.

## **Impact of estrogen on PAD2 and PAD4 enzyme regulation in**

**Lactotroph cells of the mouse pituitary**

Karli Swenson with Dr. Brian Cherrington

Zoology and Physiology

University of Wyoming

Poster Presentation

*Honors*

*Laramie, WY*

It is well documented in the research that peptidylarginine deiminase (PAD) enzymes are calcium mediated regulators that post-translationally modify protein histone tails by replacing a positively charged arginine into a neutral citrulline (Khan, 2016). Because the DNA backbone is negative, unmodified histones can bind tightly to the wrapped DNA, while the citrullinated histones will bind less tightly, interrupting the tertiary protein structure and altering downstream protein function. PAD2 and PAD4 proteins are expressed in female reproductive tissues as well as the gonadotroph and lactotroph cells of the pituitary, which mediate mouse estrus cycle, reproductive ability and lactation. The hormonal regulation of PAD2 and PAD4 enzymes is under current investigation. The goal of this ongoing project is to determine the impact of exogenous estrogen on PAD2 and PAD4 enzyme regulation in the mouse pituitary, as well as the hormonal regulation of PADs during pregnancy. Pituitary collections from mice on days 12 and 18 of pregnancy, ovariectomized mice, and control mice are collected, slide mounted, stained and analyzed to examine the presence PAD2 and PAD4. Along with image quantification, qPCR is being used to characterize the cDNA and western blot analysis is being used to identify the proteins with PAD-induced altered folding pattern. Working data shows a 13-fold increase in PAD2 mRNA 6 hours after injection of 17  $\beta$  estradiol, a consistently increasing one-to-three-fold change in PAD2 Protein expression at 1, 6, 12, 24 and 48 hours after injection, and a three-fold increase in PAD4 mRNA both 24- and 48-hour after injection.

## **The Current and Future Impacts of Wildfire on Sediment Erosion, Hydrology, Vegetation, and Fire Management Strategy in California's Chaparral Environments**

Mackensie Swift with Ms. Maggie Bourque

Geology & Geophysics

University of Wyoming

Oral Presentation

*Honors*

*Elkhart, IN*

Increasing wildfires are a pressing current issue as urban development expands into wildland environments, providing more opportunities for anthropogenic ignitions. In addition, climate change is also a major factor increasing concerns of fire potential in many areas because precipitation and temperature patterns are changing. California's chaparral communities are particularly susceptible to wildfires, and fire will only continue to grow in size and intensity as climate changes and more ignitions are available. The first focus of my project is how wildfires have altered the natural landscape in chaparral environments with respect to sediment erosion, vegetation, and hydrology. With this, current models are examined to predict what future outlooks for these processes may look like. Another consideration is the impact of climate change and how this alters wildfire outlook. The second portion of my project focuses on the organization and cooperation of fire management across federal agencies and state and local government. A big question is the effectiveness of current fire management strategy and what steps must be taken in order to prepare for new emergent issues regarding wildfire in California's chaparral environments.

## **Individual distinctiveness in vocalizations of a suboscine bird, *Ceratopipra mentalis***

Josephine Tagestad with Corey Tarwater, Ph.D. and Dan Albrecht-Mallinger

Zoology and Physiology

University of Wyoming

Oral presentation

*Wyoming Research Scholars Program*

*Thornton, CO*

Assessment of organisms' vocal traits can lead to insights regarding behavior, age, health, and identity. Studies of bird song and its functions focus almost exclusively on the learned songs of oscine birds, while the innate songs of suboscine birds have received less attention. Suboscine songbirds are assumed to be less vocally complex than their oscine counterparts, resulting in lack of individual distinctiveness in their vocalizations. Here we test whether vocalizations of the suboscine bird of *Ceratopipra mentalis*, the red-capped manakin, are individually distinctive. We examined recordings of 20 males at 10 leks across the Isthmus of Panama, extracting cadence and frequency data from whistle-peeps, a contact call males give throughout the breeding season. We used a flexible discriminant function analysis (FDFA) in Program R to test for individual identity coded in vocalizations. Based on this analysis, individual variation is present, with the FDFA assigning identity to the calls with 87% accuracy. Furthermore, individual identity explains more variation than local dialect. As *C. mentalis* is an important seed disperser and is predicted to decline with continued changes in climate, the use of vocal recordings to estimate abundance in a rapid, non-invasive way would aid in studying them in a changing world. More generally, we argue that further studies of suboscines are needed to test long-held assumptions about individual distinctiveness.

## **Measuring Infrared Emission from InSb Quantum Dots**

Ethan J. Taylor with William D. Rice

Department of Physics and Astronomy, University of Wyoming

Oral Presentation

*Honors*

*Cheyenne, WY*

Small bandgap semiconductors, such as PbS, PbSe, and InSb, that are optically sensitive to near- and mid-infrared (IR) light can be used to increase the wavelength solar spectrum sensitivity of modern, multipartite photovoltaics. As with other semiconducting materials, small bandgap semiconductors can be formed into quantum dots or colloidal nanocrystals, thus enhancing both their absorptive cross-sections and emission efficiencies, which are crucial optoelectronic parameters. Critically, the large exciton radii of many small bandgap semiconductors allows researchers to control the semiconducting bandgap by altering the quantum dot diameter around or below the exciton radius (~10 to 20 nm). Here, we discuss the design and construction of a setup to detect mid-IR (1.5 to 6  $\mu\text{m}$ ) photoluminescence (PL) using a tunable, visible excitation source. Using this system, we measure PL from 15 nm-diameter InSb quantum dots produced using Sn-seeded growth and atomic layer deposition. We find that the PL from these quantum dots is centered between 2 to 3  $\mu\text{m}$  confirming their high crystallinity and TEM-determined average ensemble diameter. In addition to these results, future measurements using high-intensity visible and near-IR excitation will be discussed.

## **New Approaches to Hydrocarbon Feedstock Conversion: Bifunctional Pd Complexes for Tunable Heterolytic C-H Activation**

Rachel Tenney with Elliott Hulley

Department of Chemistry

University of Wyoming

Poster and Oral Presentation

*Wyoming Research Scholars Program*

*Casper, WY*

C-H activation, the process of breaking the bond between a carbon and hydrogen in an organic compound, is an important reaction in the conversion of petroleum feedstocks. Our laboratory is synthesizing and studying different platforms for C-H activation that are designed to tune and control hydrocarbon functionalization. In particular, three different platforms have been developed that (1) tune the favorability of C-H activation and (2) shed light on the importance of electrophilicity on polarizing C-H bonds towards cleavage. Thus far, we have been able to establish that hydrogen atoms are rendered incredibly acidic upon coordination to Pd(II), and are susceptible to attack by even weak bases. Results from the latest synthetic and catalytic studies designed to exploit this type of thermodynamic control will be reported.

## **Power System Analysis**

Zachary Tovar with Dr. Nga Nguyen  
Electrical and Computer Engineering  
University of Wyoming  
Oral and Poster Presentation

*Electrical Engineering*

*Laramie, WY*

The power flow problem can be discovered if the requirements of a normal, balanced, three-phase, steady-state system are met. This is essential when designing and analyzing the function and efficiency of small and large power systems. This project is a combination of extensive research and analysis of a real-world power system through a power flow analysis of different systems with varying number of buses defined by IEEE Test Cases. This was done through writing a program in MATLAB that receives its data from IEEE Test Cases, and calculates the desired parameters needed for the study. The first calculation is the bus admittance matrix. Once this was calculated, an iterative method, known as Gauss-Seidel, was used to solve this matrix for the unknown values of each bus. This program then uses these results to calculate the power generated and consumed at each bus, as well as the line flows for each branch. The program outputs these results as well as the number of iterations and the tolerance to which the program converged. The program should be able to input any number of buses in a system and output the desired results. This project was completed to provide myself with a strong understanding of the power flow problem. The knowledge gained through the development of this program will lead to further, more modern, research in the area of power engineering.

## **TRPV1 activation enhances exercise endurance, mitochondrial biogenesis and fatty acid oxidation in skeletal muscle**

Heather Townsend with Dr. Baskaran Thyagarajan  
Molecular Signaling Laboratory, School of Pharmacy  
University of Wyoming  
Poster Presentation

*Wyoming Research Scholars*

*Douglas, WY*

Obesity is an imbalance between energy intake and energy expenditure. Regular exercise and calorie (energy) restriction are considered as effective strategies to counteract obesity. However, these approaches are not always applicable to everyone and are often associated with rebound weight gain when such interventions are stopped. Exercise enhances energy expenditure through increased movements and stimulation of 5' adenosine monophosphate activated protein kinase (AMPK), which serves as a cellular energy sensor. Research from our laboratory suggests that activation of transient receptor potential vanilloid subfamily 1 (TRPV1) by capsaicin activates AMPK, enhances energy expenditure and protects mice from obesity. Since both exercise and TRPV1 activation enhance AMPK, we hypothesize that regular exercise (by rigorously training mice on a rotarod for 24 minutes long and 4-days a week) and TRPV1 activation (by feeding oral capsaicin in high fat diet, HFD) enhances metabolic activity. We used wild-type and AMPK $\alpha$ 2 kinase-dead (KD; skeletal and cardiac muscle specific) mice that received a HFD  $\pm$  Capsaicin (0.01%). Weekly weight gain and food/water intake were recorded. We evaluated the expression of TRPV1, AMPK, sirtuin-1 and PGC-1 $\alpha$  in the gastrocnemius muscle and measured the respiratory quotient and heat production by indirect calorimetry. Our results indicate that CAP enhanced exercise endurance and suppressed weight gain without modifying energy intake. CAP elevated mitochondrial biogenesis and fatty acid oxidation in the gastrocnemius muscle. Our data suggests that activating TRPV1 in muscle by combining exercise and capsaicin is a promising strategy to enhance energy expenditure and counter metabolic dysfunction.

## **Speech Language Pathologist Comfort Levels Serving Students with Traumatic Brain Injury**

Holly Trujillo with Erin J. Bush, Ph.D., CCC-SLP  
Division of Communication Disorders  
University of Wyoming  
Oral Presentation

*McNair Scholars Program*

*Sheridan, WY*

Students with TBI typically struggle with language skills, reading, attention, memory and executive functioning. In 2011 researchers found that there were 26,000 U.S. students who had incurred a TBI. The previous challenges listed should be treated by school-based speech language pathologists (SLPs). A study conducted by Dr. Erin Bush and her colleagues investigated how comfortable practicing SLPs were with treating student survivors of TBI. Latent Cluster Analysis results revealed that SLPs fell into 3 groups, high comfort, moderate comfort, and low comfort. Purpose: The purpose of the study is to further explore SLPs' experiences treating students with TBI using interpretivism, a qualitative research method. This methodology provided a more in-depth view of other factors that contributed to comfort levels of these practitioners. Methods: I conducted between eight semi-structured interviews with a subset of self-selected SLPs from the survey study. Results: Preliminary results revealed a dichotomy of participants. Five participants were judged to be experts, based on their work setting and experience treating survivors of TBI, and three were judged as non-experts. Five cross-cased themes emerged: *survivor variability, recommendations, SLP' needs and resources, Work setting variability, and Barriers to providing effective services*. Significance: This research highlights the strengths and challenges of SLPs' working with students with TBI and to suggestions to improve services. More efficacious treatment services could lead to more academic and occupational success for student survivors of TBI.

## **CTE and the Accumulation of Tau Protein in the Brains of Bighorn Sheep**

Tabitha N. Tyrrell, Eric C. Atkinson, Michael F. Cuddy, and Eric Silk  
Biology, Chemistry, and Psychology Departments, Northwest College  
Poster and Oral Presentation

*INBRE*

*Cody, WY*

Bighorn sheep (*Ovis canadensis*) have long-been assumed to be immune to the consequences that arise following repetitive blunt trauma to the head, such as a traumatic brain injury. However, little to no research has been conducted to make any conclusive arguments supporting this hypothesis. Chronic traumatic encephalopathy (CTE) is a neurodegenerative disease in which tau proteins detach from the microtubules they are normally associated with and become hyperphosphorylated to form aggregations that gradually spread throughout the brain. Although tau is related to many different neurodegenerative diseases (tauopathies), this specific type of protein aggregation is unique to CTE. To determine whether or not bighorn sheep present with this specific tauopathy, we collected the brains of three sheep that were donated by a local taxidermist for our research. The brains were initially stored in the refrigerator for approximately three weeks and were then fixed in formaldehyde. The brains were then separated into the left and right hemispheres with a dissection blade. The halves were dehydrated with 90% ethanol and embedded in paraffin. The brains were then sectioned into sections of 5-10 microns using a manual microtome. We tested for tau protein aggregations by using a Gallyas silver stain. This stain was selected due to its high sensitivity to neurofibrillary tangles and protein aggregations within brain tissue. Further examination of the specimens will determine whether or not the brains present with the aforementioned tauopathy, chronic traumatic encephalopathy.

### **Drain Drone**

Jedidiah Vaskis with Dr. Robert Kubichek  
Electrical Engineering  
University of Wyoming  
Both Oral and Poster Presentation

*Powell, WY*

Pipe systems have underpinned modern civilization for centuries, but if a pipe malfunctions, it can be labor intensive to diagnose and correct the problem. Most pipe repair methods require either blindly sending a tool downpipe or digging up stretches of pipe to find the problem. The former requires luck and is often indelicate; the latter can be very costly, and sometimes is impossible. There are a handful of diagnostic tools in the market, but they are expensive and complicated. Our device attempts to alleviate much of the cost and difficulty associated with diagnosis and is cheaper and simpler than alternative devices. Our design is a user-operated, mobile camera that can be sent inside a pipe and send live, illuminated video back through cable to a screen on a handheld controller. The cable is marked with measurement increments to determine the depth of the device in the pipe. Pipe breaks or blockages can be located using the depth information and video feed. For traversal, the device has four arms, two going each direction in X and Y axis, that suspend the camera in rough center of the pipe, off of trickle or detritus. Each arm ends in a motorized wheel for grip and movement. The device is powered by an AC/DC wall adapter.

### **The Characterization of Bovine Pneumonia Using Bacterial Culture, Immunohistochemistry, and PCR**

Corinne Vaughan with Dr. Kerry Sondgeroth and Dr. Donal O'Toole  
Department of Veterinary Sciences  
University of Wyoming  
Oral Presentation

*Honors*

*Albuquerque, NM*

Bovine Respiratory Disease (BRD) is a leading cause of economic losses in the beef industry worldwide, and accounts for a majority of deaths in pre-weaned cattle after 3 weeks of age. The term is used to encompass pneumonia in cattle caused by infectious agents and environmental conditions resulting in complex pulmonary lesions. Infectious causes include both bacterial and viral agents, with current models of pathogenesis suggesting a viral infection or period of stress followed by secondary infiltration of several bacterial species. The major bacterial organisms contributing to the development of this complex are *Manheimia haemolytica*, *Histophilus somni*, *Mycoplasma bovis*, *Pasteurella multocida*, and *Trueperella pyogenes*. All of these organisms may be present in healthy cattle populations, but can infiltrate the lungs to cause pneumonia following changes in environmental conditions, or infection by viral agents. Little work has been done to definitively characterize the complex relationships between bacterial species indicated in cases of BRD. The goal of this project is to examine potential co-infection of lungs with *H. somni* and *M. bovis* using PCR, and to examine localization of these colonies in lesions by utilizing a multiplex Immunohistochemistry (IHC) staining technique as a comparison to traditional bacterial culture techniques for detection. Tests will be performed on lung tissues from a subset of cases submitted to the Wyoming State Veterinary Diagnostic Laboratory between 2016 and 2019. By better characterizing the nature of complex infections, and developing more specific methods of detection, the cattle industry will be able to better understand and treat BRD.

## **Examining the Role of c-Jun NH2-terminal Kinase in the Regulation of Female Reproduction**

Alexandra Verosky, Karagh Brummond, Brian S. Edwards, Shaihl A. Khan, Ulrich Boehm, Roger J. Davis, Amy M. Navratil

Gonadotropin releasing hormone receptor (GnRHR) activation initiates a network of signaling pathways that results in the synthesis and secretion of gonadotropins, luteinizing hormone (LH) and follicle stimulating hormone (FSH), from gonadotrope cells in the anterior pituitary. Previous work has highlighted an important role for the c-Jun NH2-terminal kinase (JNK) signaling cascade in regulating both GnRHR expression levels and pulsatile LH secretion; events that are essential for reproductive viability. However, whether JNK regulates gonadotrope function *in vivo* is not known. To specifically address this question, we utilized *Cre/loxP* technology to selectively inactivate JNK 1 and JNK 2 (JNK 1/2) in gonadotrope cells of the anterior pituitary (DKO). Interestingly, qPCR analyses revealed there is an *increase* in *FSH $\beta$*  mRNA and serum levels in DKO females. Consistent with elevated FSH levels, JNK DKO females presented with increased ovarian weights and antral follicle development. Estrous stage cycling also revealed that JNK DKO females had irregular cycles marked by prolonged diestrus and abnormal cycle length. Taken together, our results reveal a possible novel inhibitory role for JNK signaling in gonadotrope regulation of FSH $\beta$  synthesis *in vivo*.

## **Dancer's perspectives on the impact of injury on their performance ability: multiple case studies analysis.**

Amanda Vinson with Dr. Margaret Wilson and Jennifer Deckert  
Theatre and Dance  
University of Wyoming  
Oral Presentation

*Theatre and Dance*

*Centennial, CO*

An injury immediately confronts a dancer with their own limitations, which threatens the person, passion, and profession. As the dancer rehabilitates, the psychological response varies in intensity and duration. The purpose of this investigation was to study the impact of injury on a dancer's perspective on their ability to perform in class and on stage before and after an injury. Participants completed questionnaire surveys in one data collection period in which they assigned a number to a prompt to describe the impact their injury had on their performance ability for three specified time periods. Additional questions on the questionnaire allowed elaboration on their perception of the injury's overall impact. No specific trends were identified due to sample size, however the questionnaire responses generally agreed with data from the open-ended questions. Technical ability, ROM, speed, and strength were all significantly impacted immediately at injury onset. With time, these variables returned to a functional level with little to no injury impact. Fear of further injury was greatest at onset of injury and did not diminish to the same degree that the other four variables did. The residual feelings of fear support the idea that fear of injury is a predominant emotion in return to sport and a factor that increases the risk of re-injury. Responses to the remaining questions reflect a positive outcome from the injury. Future research is needed regarding the role of psychological factors and how to mediate the negative response.

**Genetic Characterization of a Novel Endosymbiont Belonging to  
*Wolbachia* in the US Sandfly**

Emily Violini and Dr. Myrna Miller  
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University of Wyoming  
Oral Presentation

*Honors*

*Salinas, CA*

An important arthropod disease vector, the sandfly carries diseases pertinent to the health of humans, wildlife, and domestic animals. Diseases of concern include *Leishmania*, an emerging disease in the United States that is endemic primarily in Southern Europe and Northern Africa. Sandflies from Laramie County, Colorado were analyzed for viruses, bacteria, and phages potentially present within their microbiome. The previous analysis of the sandflies found symbionts in the midgut, functioning in the same way that rumen microbes do in cattle. We sought to verify a specific species of the midgut symbiont, and to explore its possible uses and significance in the perspective of control and public health. Methods include utilizing Sanger sequencing of PCR product from the symbionts, as well as reviewing current literature on *Wolbachia* symbiont species. PCR product was compared to that of sandfly symbiont nucleic acid from Texas sandflies, verifying its uniqueness. Results indicated a novel species of endosymbiont, which is highlighted through a phylogenetic tree analysis. *Wolbachia* is useful for the control of arthropods that, like Sandflies, are often disease vectors with significant threats to human and animal health. The characterization of *Wolbachia* within Laramie County sandflies suggests possible disease control methods should an emerging disease for which it is a vector spread to the region.

**A (Mostly) Analog Multi-Effects Pedal**

Leland Wallace with Dr. Cameron H.G. Wright  
Electrical & Computer Engineering  
University of Wyoming  
Oral & poster presentation

*Laramie, WY*

This project proposes a solution to the advent of poor-sounding digital multi-effects units in the electric guitar world. Rather than modeling popular guitar effects using digital technology, this project creates a unit that houses authentic, vintage analog effects as well as modern digital effects to create a harmonious union of technologies from past and present. Digital multi-effects units are becoming increasingly ubiquitous among electric guitarists. However, they sound unnatural and forced. In contrast, previously-owned vintage effects pedals, such as the Ibanez TS-808, increase in price every year. While musicians long for the convenience of modern technology, old technologies are often sonically preferred. To combine modern technology with old technology in one convenient package, well-known existing guitar effects (analog and digital alike) are researched, recreated, and tweaked. Rather than reinventing common effects (i.e. fuzz, distortion, overdrive, boost, delay, and reverb), the engineer looks toward classic analog circuits and digital algorithms that produce classic, quality sounds. The purpose of this project is to provide a user with access to four analog guitar effects modeled on classic circuits as well as two digital effects that allow for basic delays. It should serve as a reminder that modern digital technology can be used in conjunction with, rather than opposition to, analog technology. It is also hoped that the project raises awareness among fellow guitarists that being in touch with one's instrument and technology can help achieve the musician's unique sound.

**Probing Electrocatalytic CO<sub>2</sub> Reduction at Individual Cu Nanostructures via Optically Targeted Electrochemical Cell Microscopy**

Joshua Walmsley with Dr. Caleb Hill

Chemistry

University of Wyoming

Poster Presentation

*Wyoming Research Scholars Program & NASA Space Grant*

*Douglas, WY*

Optically targeted electrochemical cell microscopy (OTECCM) was applied to measure electrocatalytic rates at individual Cu nanoparticles (NPs) under electrolyte conditions relevant to CO<sub>2</sub> reduction. The electrocatalytic responses from individual NPs were found to exhibit a wide variation in behavior, with significant NP-to-NP variations in the magnitude of electrocatalytic currents and necessary overpotentials being observed. Correlations of these quantities with metrics of NP size suggest no significant variations in the inherent electrocatalytic activity of the NPs with size. Finite element simulations of diffusion in this system demonstrate the observed diffusion-limited currents are significantly smaller than expected, attributable to the presence of a significant amount of residual ligand on the surface of the Cu NPs, which were prepared via an organic phase synthesis. The results presented here further demonstrate the promise of techniques which employ correlated optical and electrochemical measurements, such as OTECCM, for studying electrocatalysis at individual NPs.

**Examining Individual Vocalization Signatures in Zebra Finches**

Joy M. Watkins with Lisa P. Barrett and Dr. Benson-Amram

Zoology & Physiology

University of Wyoming

Oral & Poster Presentation

*INBRE, Honors*

*Laramie, WY*

The gregarious zebra finch (*Taeniopygia guttata*) is a monogamous species that is well-suited for many types of behavioral studies, as zebra finches are a socially complex species and easily kept in captivity. Animal communication facilitates specific actions among conspecifics, such as cooperative, competitive, or defensive behaviors. Specifically, individual calling signatures between conspecifics may provide insight into individual identification and could serve as a critical recognition cue of behavioral state. Here, we discuss the relationship between vocal communication and coordinated problem solving in pair-bonded zebra finches. We evaluated the methods of collecting and analyzing the vocal repertoire of adult zebra finches. The spectral features that have been utilized to categorize eleven distinct calling types were analyzed with Raven Pro acoustical software and the 'warbleR' package in R. Downstream analysis utilized Python to discriminate between temporal and fundamental frequencies of calls.

## **Application of Bismarck Brown Y dye as a short-term biological marker**

Colton Webb, Brody Garner, William Fetzer, PhD, Steve Gale

Department of Zoology and Physiology

University of Wyoming

Poster

*Wyoming Game and Fish Department*

*Windsor, CO*

To effectively make sound management decisions, population estimates are critical for fisheries managers. However, they can be difficult to obtain for small fish species. We conducted a laboratory experiment to determine which concentrations of Bismarck Brown Y solution (1:15,000/ 1:30,000/ 1:60,000) and fish exposure time (one and two hours) provided the most effective mark retention over a five-day experiment. Iowa Darter (*Etheostoma exile*) exposed to a dye solution for two hours displayed the most noticeable dye coloration after 96.75 elapsed hours indicating exposure time is more critical than dye concentration. A field experiment was conducted to evaluate the feasibility of this short-term biological marker in mark-recapture population estimates. Captured darters were dyed in a Bismarck Brown Y solution [1:15,000] for two-hours and then recaptured approximately 57 hours later. This field experiment displayed the benefit of Bismarck Brown Y to be safe to use on small fish species while allowing users to have a wide margin of error of dye solution concentration when mixing it in the field. Recommended use of Bismarck Brown Y as a marking method would include when managers need a short-term mass marking of sensitive species, accessibility to new equipment is restricted, and financial resources are limited. Use of Bismarck Brown Y would not be recommended to use if trying to track fish over time or when information about a specific fish is needed.

## **Herbicide Application for Newly Seeded Desirable Grasses**

Nancy Webb and Brian Mealor

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Oral Presentation

*Agricultural Experiment Station*

*Riverton, WY*

The Northeast Wyoming Invasive Grasses Working, a cooperative working to control invasive grass in Wyoming, has implemented chemical control of medusahead wildrye (*Taeniatherum caput-medusae*) and ventenata (*Ventenata dubia*) for several years. Herbicides are effective for reducing annuals, but species-specific information on herbicide tolerance of desirable grasses at the seedling stage is limited. A greenhouse study at the Sheridan Research and Extension Center investigated the response of seven desirable grass species to various herbicides applied prior to seedling emergence. We tracked plant growth and documented herbicide injury to individual plants throughout the study. Plants were harvested, dried, and weighed three months after application. We analyzed biomass data consistent with a dose-response study using nonlinear regression and observed species-specific and herbicide-specific responses. Plateau + Milestone herbicides had the greatest negative effect across grass species, indicating the potential need for two-year interval between herbicide application and reseeding. Intermediate wheatgrass (*Thinopyrum intermedium*), a non-native forage species, consistently tolerated herbicides better than other grasses in the study. Green needlegrass (*Hesperostipa comata*), a native, cool-season bunchgrass, had relatively poor establishment and low herbicide tolerance under our greenhouse conditions. Our results suggest management tradeoffs that may exist. If the goal is to restore native plant diversity in the presence of invasive grass competition, then the best performing species – intermediate wheatgrass – does not meet the management requirements.

## **Acute Blood Pressure Response following High Intensity Functional Resistance Training**

Brittney Wells and Dr. Evan Johnson

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University of Wyoming

Oral and Poster Presentation

*INBRE*

*Colorado Springs, CO*

Moderate intensity continuous exercise (MICE) and resistance training (RT) produce immediate reductions in blood pressure (BP), which persist for ~24hr (post-exercise hypotension [PEH]). High intensity functional resistance training (HIFRT) has increased in popularity, however, the magnitude of PEH following HIFRT has yet to be quantified. Assess the BP responses to a bout of HIFRT. 19 participants (6 female, 174.7±7.8 cm, 77.92±13.7 kg, 25.8±6.5 yr, with training experience of 3.5±1.3 y) performed a standardized workout (1-mile run, 100 pull-ups, 200 push-ups, 300 squats, and a final 1-mile run). Systolic BP (SBP), diastolic BP (DBP), and mean arterial pressure (MAP) were measured: pre- (baseline), post-, 24h post-, and 48h post-workout. HIFRT duration and intensity were 56.9±11.6 min and 75.2±5.5% of age predicted max heart rate, respectively. Resting BP was considered normal to elevated (121.8±2.6, 76.3±1.9 mmHg). Immediately post, 24h post, and 48h post HIFRT BP decreased from baseline (-14.1±2.9, -7.6±1.9, -6.1±2.1 mmHg), and (-4.9±1.1, 5.8±1.8, -4.5±1.4 mmHg; all  $p < 0.005$ ) for SBP and DBP, respectively. Similar results were seen for MAP at immediately post (-8.0±1.4 mmHg), 24hr post (-6.4±1.7 mmHg), and 48hr post (-5.0±1.4 mmHg, all  $p \leq .009$ ). Clinically meaningful reductions in BP persisted for 48 hours following a single bout of HIFRT. It is recommended that next studies incorporate larger samples with hypertension to confirm these findings and determine whether HIFRT translates to better BP control than MICE/RT alone.

## **What Changes in Active Prevention Strategies for Obesity in Children and Adolescents Could Help to Decrease the Incidence of Type 2 Diabetes Mellitus?**

Avery White with Dr. Jenifer Thomas

University of Wyoming

Oral Presentation

*Honors*

*Rapid City, SD*

Diabetes mellitus is a disease with centuries of history, but knowledge about this disease and its treatment has increased exponentially in the past hundred years. Type 2 diabetes mellitus (T2DM) occurs when the body is not capable of producing a sufficient amount of insulin or when cells acquire insulin resistance (Polonsky, 2012). T2DM's prevalence has risen drastically in the previous 20 years, and it is predicted that 1 in 3 people will have diabetes by 2050 (Polonsky, 2012). Weight gain and obesity are associated with T2DM. Approximately one-third of children in the United States in 2014 were either overweight or obese (Pulgaron, 2014). This escalation of childhood obesity is correlated with the increase in risk of development of T2DM in children. The purpose of this research was to analyze articles for new, innovative ideas to assist with decreasing the prevalence of obesity and T2DM in children. Research was obtained using WyoLibraries to collect articles containing the key terms: "type 2 diabetes in children", "history of diabetes mellitus", "increase in type 2 diabetes", "obesity in children". Risk factors (lifestyle, gender, puberty, race/ ethnicity, genetics), prevention strategies and protective factors (distinguishing those at risk, lifestyle behavior changes, pharmacological therapy, early diagnosis) were identified. The introduction of teaching kitchens, health improvement classes, team based approaches and prevention programs were recognized as ways to decrease T2DM's prevalence in children.

## **Interrupt Driven MIDI Effect Control Pedal**

Nic Whites and Phil Black  
Electrical and Computer Engineering  
University of Wyoming  
Poster Presentation

Gillette and Casper, WY

For years, the music industry puts out newer and more efficient controllers to mix music more effectively and more intuitively. Our design is a blend of those two ideas. With the foundation of our controller being ran by a MSP430G2553, we opted for a completely interrupt driven system with foot pedals to control tracks. Along with the use of foot pedals, we designed a visual feedback system allowing for a simple, but elegant system for quick on the fly selection of tracks.

## **Effects of a Culture Rich Home and Community: A Study of cultural traditions on Native Youth and their life paths**

Christie Wildcat  
Angela Jaime  
Native American and Indigenous Studies  
University of Wyoming

Culture is life, the air we breathe, and our future. As a child I was raised in a culturally rich environment, inside and out of the home. Culture is important because it gave me and others a sense of purpose in life, a connection to something bigger than us. Raising a child in a culturally rich and strong environment is essential to children choosing the path of education and a prosperous future. The article, "Incorporating Traditional Culture into Positive Youth Development Programs with American Indian/Alaska Native Youth" explains, "The majority of research and programs for American Indian/Alaska Native (AI/AN) youth focus on negative health behaviors and risks, ignoring the positive attributes that traditional AI/AN culture can provide" (Kenyon & Hanson 2012, para. #). Focusing solely on the behavior of Native youth and the consequences of their behavior, rather than the solutions or positive influence of culture creates a deficit perspective on Native youth. This paints a negative generalization of Native culture and community. This qualitative study intends to create space for the stories of youth and their families in culturally rich environments, the positive influence of culture in youth decision making and ways in which educators and community members can support positive self-awareness in community and school environments.

## **Comparison of Visual Analog Pain Score Reported to Physician vs Nurse in Postoperative Foot and Ankle Patients**

Aaron Wilke

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Poster

*Colorado Springs, CO*

The relativity of pain adds to the increasing ambiguity of deciding proper treatment procedures. Reliable and validated patient reported outcome measures have attempted to solve this problem, but there are still flaws due to the subjective nature of pain. This study is the third part to two previous studies that found both operative and nonoperative patients overemphasize their pain scores when reporting to the physician as compared to a nurse. This current study aims to examine if this phenomenon holds true with orthopedic postoperative patients. The importance of this study is to better understand this phenomenon. We hypothesize there will be no differences in postoperative patients' pain scores when reporting to a treating physician versus a nurse. This study is a retrospective cohort of consecutive postoperative foot and ankle patients treated by a single surgeon. The patients were asked to rate their pain intensity by the nursing staff and then by the surgeon using a standard horizontal visual analog scale (VAS) 0 to 10, from "no pain" to "worst pain" at 2, 6, and 12 weeks postoperatively. The mean 2-week postoperative VAS reported to the physician was significantly higher (2.86; 95% confidence interval [CI]: 0 to 8) than that reported to the nurse (2.53; CI 95%: 0 to 9;  $p < 0.001$ ). No significant differences were noted in the VAS scores reported at 6 (2.86/2.53) and 12 (2.33/2.02) weeks postoperatively. This study found that postoperative patients report their pain more consistently to physicians and nursing staff with no clinically significant differences noted.

## **The economics of player-vs.-player ship combat in EVE Online**

Jacob Williams with Dr. Scott Crawford

Mathematics and Statistics

University of Wyoming

Poster and Oral Presentations

*Honors and Department of Mathematics and Statistics*

*Centennial, WY*

At times, more than thirty thousand people reside in New Eden, the expansive galaxy of EVE Online. Starships ranging from nimble frigates to behemoth Titans have mined for resources, explored vast swaths of unknown space, and waged wars over the fate of empires since 2003. Indeed, the politics and economics of EVE approach the sophistication of their real-world counterparts: there are bankers and stockbrokers, bureaucrats and spymasters, fleet commanders and marauders in no short supply. The number of possibilities can be overwhelming to a new player of EVE, as each aspect of the game can take years to master, and competition is fierce. When a starship is destroyed in player-versus-player combat, the value in Interstellar Kredits (ISK) that is irrevocably destroyed, as well as the ISK value lost to its pilot, are made publicly available each month by the EVE developers. We here create a model predicting the ISK recoverable to the destroyer of the ship (or to scavengers nearby) according to other parameters released in the data documenting the destruction, such as the kind of ship destroyed, its final location, whether its pilot had a bounty on his or her head, and the time of day at which the final blow was struck. We believe that our analysis will help bring players satisfaction and enjoyment by helping players more efficiently direct their player-vs.-player combat energies to profitable targets, or conversely to avoid more effectively having their own ships destroyed for ISK.

## **No Words**

Gabrielle Wollert with Diane Panozzo  
Business Management  
University of Wyoming  
Oral and Poster Presentation

*Honors*

*Lingle, WY*

This project's purpose is to explore and highlight avenues of self-expression through poetry and visual art. My aim is to bring a creative project that is not defined by scientific research, but rather self-exploration. Personal awareness and exploration are key to my education outside of formalized academic learning. Learning should represent growth in many different avenues regardless of academic guidelines. The project is rooted in artistic flare. Each poem highlights a genre of personal experience and encompass an overarching theme of my personal development and self-awareness. Genres of poetry include travel, upbringing, hardships, and self-exploration. The poetry is accompanied by an essay describing the inspiration behind each poem as well as a description of the process of creating a final draft of poetry. Furthermore, I have represented the tone of certain poems using visual art. Working with local artists, I am using a Strappo technique of acrylic painting to further express a process of development. This technique requires forethought, the main subject is painted first, and detail layers are painted on in sequence after. The final project product will be a combination of written, visual, and mental expression.

## **Voluntourism Uncovered: Toward a Standard for Meaningful Work**

Emily Wood with Dr. Thomas Seitz  
SPPAIS  
University of Wyoming  
Oral Presentation

*Honors*

*Cheyenne, WY*

Many university students want to make a difference in the world by volunteering abroad. Volunteer tourism, or voluntourism, is a type of travel program in which participants have the chance to "give back to the community." Programs are typically short term and can include work with orphanages, construction, or other fields in which participants often have little knowledge or few skills to offer. Critics have claimed that voluntourism may be more damaging than helpful. This study examines the voluntourism industry, its stated goals, and its effects on host communities. Methods utilized are content-analysis of program websites as well as interviews with personnel in host organizations, university study abroad offices, and potential and returning voluntourists. The goal of this analysis is to generate criteria for evaluating voluntourism programs. These criteria can be used by study abroad offices and implementing organizations to identify ethical and sustainable programs that work closely with host communities and participants and achieve the goals that they intend to. Hopefully this can create a standard for potential participants to identify which organizations are beneficial for host communities. Because opportunities for voluntourism are not going to disappear anytime soon, it is essential to raise awareness and promote programming that is meaningful to both host communities and voluntourists.

## **Liquid Crystalline Elastomers as Dampers in Helmets**

Jason Young with Dr. Carl Frick

Mechanical Engineering

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Poster Presentation

*EPSCoR*

*Laramie, WY*

Head injuries, namely concussions and CTE, are major concerns for football enthusiasts. With leading research indicating that repetitive impacts have severe impacts on the brain, innovations in helmet technology are necessary if football is to survive. Liquid Crystalline Elastomers (LCEs) have vastly superior energy dissipation properties relative to traditional elastomers. Preliminary findings and results reported in scientific literature indicate its high potential for use as a damping material, particularly in impact mitigation. Utilization of LCEs in protective helmets alongside or replacing the energy dissipating liner can lead to improved helmet design. The goal of this project was to characterize the effect of the chemical composition and reaction condition on the damping behavior of LCEs. Furthermore, this project investigated the fatigue behavior of both solid and porous LCEs by fabricating and testing samples under various cyclic loading scenarios. Finally, in conjunction with a mechanical engineering senior design team, helmets with LCEs incorporated into their structure were tested under impact loading to assess the efficacy of LCEs over traditional materials. Preliminary findings indicated that engineered porous LCEs have superior damping characteristics in comparison to other polymers and could outperform commercial polymers in the mitigation of impacts when used in helmets.

## **Sleep patterns in Tweets: a time-series analysis of key words use related to sleep**

Colton Zier with Eric Brist, Pavel Chernyavskiy

University of Wyoming

Social media is a vastly growing industry that provides a quick look into many different aspects of an individual's life. This outlet of social media is a heavily underused resource in analysis. Social media is a very inexpensive way of gathering large amounts of data for analysis. Here, we analyze trends of sleep patterns based on key words related to sleep from August 1<sup>st</sup> 2018 – December 29<sup>th</sup> 2018. We have aggregated the content of each tweet given by month, day, and hour to give us a count of each key phrase/word related to sleep per hour. This formed a time series of counts for each key words that was then standardized by total amount of tweets for each hour. In this analysis, we treated each sleep-related key word as independent from other sleep-related key words. We excluded key words that did not provide enough data to analyze related to: sleep tracker, it's because of social media, ambien-cr, ambiencr, eszopiclone, liquid sleep, and emojis. The time series of counts was analyzed using the GLARMA package in R 3.5.1. For many of the key word-specific time series we have noticed some cyclical patterns at different time scales. Using the Augmented Dickey-Fuller test we have evidence of stationarity over time with the series. This form of analysis could be very useful for future research with any other count data from a social media platform. An example of this could be likes on a picture on Instagram.

# **Virtual Reality Takes Over: Assessing the Impacts of VR on Architecture and the AEC Industry**

Andrew Apodaca  
University of Wyoming

This research evaluates the use of Virtual Reality (VR) as a design and communication tool used by architects with clients during virtual design reviews. Seven residential projects are specifically evaluated with feedback surveys from thirteen clients, highlighting the added value of the experience to the client/architect relationship.