# UCUR 2016 Abstracts Booklet

**Welcome to the UCUR 2016 Abstracts Booklet!**

Students presenting at the Utah Conference on Undergraduate Research (UCUR) on February 19, 2016, were invited to submit their abstracts for inclusion in this booklet.

We hope you enjoy reading about the excellent research being conducted by undergraduate students throughout the state of Utah!

Abstracts are presented in alphabetical order by author.

# The Role of Interpersonal Relationships and How They Affect Pornography Usage

Cameron Alldredge (Southern Utah University); Jim Mock (Southern Utah University); Daniel Hatch (Southern Utah University)
*Faculty Mentor: Jim Mock*

A recent survey found 63% of men between the ages of 18 and 30 view pornography several times a week and 79% view it at least once a month. It is estimated that 40 million adults in the United States alone regularly visit pornographic websites. Though there is resistance to classifying compulsive pornography usage as an addiction, the adverse effects have been well documented. While adequate research is being conducted about pornography usage focusing on trends and consequences, there isn't a lot of emphasis placed on outside factors that may contribute to the exacerbation or alleviation of this issue. Though they often serve on the front lines, clinical therapists who work with this population have been overlooked as a source of information. This study explores what role interpersonal relationships play in the formation and resolution of problematic pornography viewing, specifically from the perspective of the clinician. Methodology included selecting five therapists who specialize in pornography addiction treatment and conducting extensive interviews regarding their theories of development and intervention. Each of them have worked with this issue for five to ten years making them valuable in learning more about this topic. Using a phenomenological approach, responses are currently being analyzed for reoccurring themes with particular focus given to the roles of interpersonal relationships. Early analysis suggests that these relationships play a crucial role in this pressing issue. Final results are currently being developed and will discuss the function of these relationships in greater detail.

# The Effects of Re-contextualization on Vernacular Architecture: Yin Yu Tang House

Mariko Azuma (University of Utah)
*Faculty Mentor: Winston Kyan*

My paper on the cultural and architectural re-contextualization of the Yin Yu Tang House, or Hall of Abundant Shelter, at the Peabody Essex Museum in Salem, MA, has two main goals: 1) to consider the connections between architecture, space, and the family in a traditional Chinese house; and 2) to examine how these connections are re-installed, re-presented, and re-interpreted as this building is moved from its original location in Anhui Province, China, to an American museum in New England. Although the Peabody Essex Museum includes more than twenty pre-Civil War buildings, the Yin Yu Tang House is a component of the museum's collection that stands out from the rest of the architecture due to its exceptional construction, preservation, and cultural foreignness. Along with the architecture itself, the Yin Yu Tang House has brought over its 200-year-old history and culture of the Huang family and Anhui province to the museum. By being moved to a new context, Yin Yu Tang's already historical identity becomes even more intricately layered than before and presents questions about the interpretation of historic environments. How has the Yin Yu Tang House renewed public memory of Chinese culture and transformed the house into a form of refined vernacular architecture for Western visitors at the museum? Building upon my recent participation and experience at the Western Conference of the Association for Asian Studies (WCAAS), my research will also examine the notion of "authenticity" in the process of re-contextualization. Authenticity is a consistently contested and changing idea in cultural representation. By examining the history of presenting foreign cultures outside of its original context and applying that to the modern ideas about representing authenticity, I argue that Yin Yu Tang House is a unique space that is an immersive microcosm from the past, revealing how closely related authenticity and context are.

# In-Class Participation Gender Gaps in Upper-Level Life Sciences Courses

Michelle Baek (Brigham Young University); Shannon Rose (Brigham Young University); Katie Fairholm (Brigham Young University); Clint Morris (Brigham Young University); Nicholas Nelson (Brigham Young University); Nicole Rice (Brigham Young University); Patrick Stockdale (Brigham Young University); Kurt Williams (Brigham Young University); Elizabeth Bailey (Brigham Young University)
*Faculty Mentor: Elizabeth Bailey*

It is well known that undergraduate women are underrepresented in STEM disciplines, but the explanation for this phenomenon is not completely understood. Interestingly, the life sciences are often considered an exception to STEM gender bias since it is common to observe a greater proportion of females in bioscience majors. However, a clear gap is seen in postgraduates of biology disciplines as females fall short in relation to males when postdoctorate appointments and career opportunities are compared. Presumably, this inequity is influenced by earlier experiences that affect male and female confidence and performance in the discipline. This study aims to examine gender bias in regards to in- class participation in life sciences undergraduate courses. This particular aspect of the education experience was chosen because in-class participation has been shown to be related to retention in a specific discipline, ability in a course topic, and increased critical thinking skills. A better understanding of gender gaps in classroom participation could be used to design simple interventions that instructors could implement in their own classrooms. We investigated in-class participation of eighteen small (25- 100 students) upper-level (200-, 300-, and 400-level) classes in the life sciences college of a large, private university. In order to investigate the dependence of female participation on instructor gender, we chose courses taught by a male instructor and others taught by a female. Pairs of student researchers (a male and a female) sat in on each course at least three times and recorded all participation events during the class period, including verbal interactions between the instructor and a student and raised hands. The percentage of verbal participation events performed by female students was significantly lower than the percentage of students present who were female. Excluding the effect of "talkers" did not eliminate this gap. Similar results were obtained when only specific types of participation were compared to the percent attending. These gaps were specific to life sciences classes. Interestingly, the gender of the instructor had no effect on any of these data. The bias was not blatantly imposed by the instructor, since the percentage of females that were called on (taken from the population who raised their hand) was higher than that of males. Correlation between the participation gap and actual student performance will also be investigated.

# Impact of Age on Water Shortage Concern

Viviane Baji (Utah State University); Douglas Jackson-Smith (Utah State University)
*Faculty Mentor: Douglas Jackson-Smith*

Utah's population is expected to almost double by 2050. It is unclear whether current water will be able to accommodate the needs of the future. Changes in water use are likely to require a social consensus that there is a problem that needs to be solved. Hence perceptions of the adequacy of the water supply (and concerns about potential shortages) are expected to be key factors that will influence water use behaviors. This project explores the research question: "Are young people in Utah more concerned about water shortages than older cohorts?" It was expected that young people would be more concerned about water shortages than other age groups. To address my research question, I used data from a major public survey that was conducted between September 2014 and November 2015 from a large random sample of adults shopping at grocery stores in urban areas across the state. Overall, the teams approached over 18,000 adults and received usable responses from over 6,800 respondents. I use bivariate and multivariate statistical techniques to investigate the relationship between the age of respondents and their perceptions and concerns about water shortages. The dependent variable is an additive index comprised of answers to three questions: 1) To what extent do you agree or disagree that there is enough water to meet the current needs of all the people and businesses in your community, 2) To what extent do you agree or disagree that there is enough water to meet the current needs of all the people and businesses in your community, and 3) Thinking about the next ten years in your community, how concerned are you about each of the following issues? The respondents were able to answer each question on a scale from 1-5, and the combined scale scores range from 3 to 15. Results showed that adults in each age group are concerned about future water. A comparison of mean scores on the additive scale indicates that 18-29 year olds were the least concerned about water shortages and the least likely to perceive a water shortage problem. By contrast, respondents aged 50 and older had the highest levels. These findings remain significant even after controlling for gender, education, and being a Utah native. These findings contradict my hypothesis that younger people would be more concerned about water shortages in Utah. My findings can help shed light on the nature of environmental concern as either a cohort or period effect. Furthermore, the findings suggest a challenge for public officials seeking the support of young people to make investments and changes in behavior to prevent future water supply difficulties.

# Religiosity may not predict better body image: a study in sub-clinical women

Kiley Ballew (University of Nevada, Las Vegas); Jordan Sgro (Brigham Young University); Erin Kaseda (Brigham Young University); Adriane Cavallini (Brigham Young University); Spencer Nielson (Brigham Young University); Kristen Ray (Brigham Young University); Chris Herron (Brigham Young University); Kyle Eversole (Brigham Young University); Katie Hyatt (Brigham Young University); Wendy C. Birmingham (Brigham Young University)
*Faculty Mentor: Wendy C. Birmingham*

Background: Previous research regarding religion and body image has focused on how religion can help women who are recovering from eating disorders. Much of the literature has also indicated that having a secure attachment with God can help during recovery of these eating disorders. However, the literature does not address how religion and engaging in religious behaviors may influence the way women view their own bodies.Method: As part of a larger study, we examined the relationship between religious involvement and body image in 24 married, mostly white (95.8%) women ages 18-50 (M=30). We assessed religious involvement with the Brief Multidimensional Measure of Religiousness/Spirituality (BMMRS). Women were considered religious if they reported attending church at least once a month. We used the Body Assessment Questionnaire (BAQ) to measure how women felt about their bodies and how they view themselves. Following the completion of these questionnaires, one-on-one interviews were conducted to obtain richer data that would allow us to assess how the women felt religion and spirituality affect a woman's body image.Results: Of the 24 women in our sample, 79.1% attend church at least once a month, therefore qualifying them as religious. Of this group, 70.8% stated that religion does improve a woman's body image. However, despite these statements, when asked the question "When I see myself nude in the mirror, my reaction is...", most (78.9%) of the religious women responded with negative self-evaluative phrases, such as "appalled," "gross," "you look awful," and "blah."Conclusion/Significance: Our results demonstrate that there may be a disconnect between religious women's perceptions of how much religion theoretically affects a woman's body image, and the reality of their own religious activities and body image. The women categorized as religious claim that their religion has a positive influence on their own body image and improves it, but contradict these statements as they self-report negative words/phrases about their own bodies in the written response question.

# Does water-based outdoor recreation have an impact on the environmental perceptions and concerns of Utahns?

Matthew Barnett (Utah State University); Douglas Jackson-Smith (Utah State University); Melissa Haeffner (Utah State University)
*Faculty Mentor: Douglas Jackson-Smith*

The potential relationship between participation in outdoor recreation and environmental concern is one of great interest to the social science community and to environmental and natural resource sociologists in particular. Since the mid-1970's, there has been a robust debate concerning the impact that outdoor recreation has on people's attitudes and concerns toward the natural environment. Using data that I helped to collect with the iUtah project's Utah Water Survey over the course of the summer, I will contribute to this debate. The Utah Water Survey is an ongoing effort to explore the perceptions of Utahns concerning water issues. The survey team used cluster sampling to select large grocery stores in communities from across the urbanized areas of Utah. Adult shoppers entering selected grocery stores were intercepted by students from institutions of higher learning across the state and asked to complete a brief anonymous iPad survey. The Utah Water Survey currently contains 6,891 respondents and has a 40.6% response rate. Survey respondents were asked about their perceptions of water quality in their community, both for nearby mountain rivers and lakes as well as downstream streams and rivers; as well as their level of concern towards water issues and other environmental issues such as air quality and global warming. Respondents are also asked questions about their own housing and individual characteristics, including: property ownership, lawn care responsibilities, frequency of participation in outdoor recreational activities, age, gender, and geographic location (zip code), and whether or not the respondents are originally from Utah. For the purposes of my analysis, four water recreation items are used (boating, fishing, snowsports, and walking or hiking near water). A composite variable consisting of the four water recreation items was also used in the analysis. The aforementioned water quality perception items and environmental concern items are also relevant. Preliminary results indicate that there are significant relationships between participation in certain types of outdoor recreation and concern toward environmental issues. Initial multivariate analysis controlling for sociodemographic factors such as gender, age, education, and Utah nativity indicated that relationships between recreation and environmental remain.

# George E. Wahlen Veterans Home- A Community

Jane Bashford (Weber State University)
*Faculty Mentor: Kristen Arnold*

The George E. Wahlen Veterans Home is a facility located in Ogden, Utah. The home serves over 120 veterans from all branches of service and from various backgrounds. The current space contains resident pods, which hold resident rooms, dining and living space, a therapy center and a multipurpose room. The current facility does not provide adequate socialization and community areas, so a renovation of the space will take place to better fit the leisure and lifestyle needs of the elderly residents who live at the veterans home. According to Yang-Chih Fu and Su-Yen Chen, authors of "Leisure Participation and Enjoyment Among the Elderly: Individual Characteristics and Sociability", participating in physical activities has health benefits such as improving functional ability and psychological well-being. They also state that elderly social interaction leads to satisfaction and successful aging (2008). In order to meet the residents' needs for physical and social well-being, this proposed renovation will create space for the elderly to participate in these activities and improve their lives. The proposal for renovation includes a ballroom, a convenience store, classrooms, updated outdoor space, a library, communal space and a therapy center. These additions and renovations will provide adequate space and ample opportunities for community involvement, leisure activities and social interaction. In addition to the reconfiguration of the space, updated furnishings and sustainable finishes will be installed to create a fresh living environment for the residents. Overall, this design will infuse the home with energy and liveliness.

# REBUILDING THE SHREE SHIVA SHAKTI ELEMENTARY SCHOOL OF GORKHA, NEPAL.

Sagar Basnet (Utah Valley University)
*Faculty Mentor: Gregory Jackson*

The 7.8 M "Gorkha Earthquake" on April 25th 2015 and the 7.3M aftershock on May 12th devastated my home country, Nepal. Taken together, they caused the death of over 8,800 people, seriously injured another 30,000, and pushed one million people over the poverty line. Thousands were instantly homeless. Entire villages were turned into debris. These problems have been further exacerbated by the fact that Nepal is one of the poorest countries in the world and lacks the ability to rebuild its infrastructure. The destruction of the educational infrastructure alone posed an enormous challenge as "almost 24,000 classrooms were damaged or destroyed" and left "almost one million children who were enrolled in school before the earthquake" without school buildings (UNICEF, http://www.unicef.org/media/media_81802.html). My country and its future generations were at grave risk. As such, I chose to return to Nepal and undertake rebuilding the school in my home village. With the encouragement and support of my Faculty Mentor at UVU, Professor Gregory Jackson, this project became my Senior Integrated Studies Capstone Thesis Project. Rebuilding the "Shree Shakti Elementary School of Gorkha" (located 25miles, SW from the Earthquake epicenter in Gorkha, Nepal) was a massive undertaking. The immediate requirement was to secure funding for the project. Accordingly, I raised $10,829 through a "GoFundMe" page, partnered with Nepalese agencies, imported building materials from abroad, and organized volunteer workers from the community. The undertaking was so extensive that it has been featured in both the Deseret News (http://www.deseretnews.com/article/865638298/UVU-student-determined-to-rebuild-hometown-school-in-earthquake-torn-Nepal.html?pg=all) and the Daily Herald (http://www.heraldextra.com/news/community/higher-education/uvu-student-returns-to-his-native-nepal-to-rebuild-school/article_3d465d84-f2a5-543d-9aa4-f8c4568740a9.html). The four-room school was completed in October 2015 and has been built to withstand future earthquakes. My poster presentation will explain the fundraising, business practices, construction, potential staffing of teachers and administrators, political workings, and cultural integration that were required to make this school a reality.

# Childhood Pornography Exposure: An Exploration and Comparison

Lacy A. Bentley (University of Utah)
*Faculty Mentor: Cameron John*

Numerous conversations are happening around pornography usage and addiction. Most previous studies focus on men, whether they are about usage, addiction, initial exposure or subsequent affect. This study investigates a broader context of "pornography" and seeks to understand the female dynamic of not only exposure, but subsequent usage and current belief systems. Striking differences between what women use after initial exposure and remembered feelings after their first experience are found in this study. It is our hope this research will broaden the definition and dialogues around pornography. Participants in this study report exposure at lower mean age than previously reported. We therefore propose a re-evaluation of mean age at time of exposure, and follow up studies addressing the unique dynamics of the female experience.

# Biophysical Characterization of DNA Interactions by the Methyl-CpG Binding Protein Kaiso

Ben Berger (University of Utah); Marta Szulik (University of Utah); Michael Young (University of Utah); Alan Chugg (University of Utah)
*Faculty Mentor: Bethany Buck-Koehntop*

In recent years, the burgeoning field of epigenetics has earned a place in the spotlight of biochemical and clinical research. Among epigenetic modifications, which produce heritable changes in gene expression without alterations in corresponding DNA sequences, the methylation of cytosine bases in the context of CpG dinucleotides has established importance in gene regulation. DNA methylation serves as a marker that is recognized by specific transcription factors, which induce the remodeling of chromatin into transcriptionally active or inactive states, thus effectively modulating gene expression. This recently elucidated layer of regulation plays a central role in cell development and differentiation as well as genome maintenance and stability. Aberrations in DNA methylation patterns have been associated with a host of pathologies, including cancer. These disease states are a product of the misdirected function of proteins that recognize and act according to these epigenetic markers. Kaiso is one such protein, which employs Cys2His2 zinc fingers in selectively binding methylated and sequence-specific unmethylated DNA sites and altering associated transcription. Here, we employ a mutagenesis study in conjunction with Nuclear Magnetic Resonance (NMR) spectroscopy and Electrophoretic Mobility Shift Assays (EMSA) to characterize crucial amino acid residues in Kaiso's DNA recognition and binding, as identified by previous structural studies. These experiments further illuminate the intricacies of Kaiso's bimodal DNA binding, indicating the crucial discriminatory role played by a crucial residue in DNA recognition.

# Antibiotic producing Bacillus isolated from soil in my own back yard

Bailee Bird (Utah State University)
*Faculty Mentor: Lianna Etchberger*

Soil sustains human lives through agriculture and provides a steady foundation for daily activities. There are approximately 2.6x10^28 (260 billion billion billion) different individual prokaryotic cells in soil across the planet (Hernandez, 2015). Bacteria help us thrive by producing a defense mechanism that we know as antibiotics. When the power of antibiotics was discovered, it opened the door to a new instrument that would push our species to live a longer, healthier life by substantially decreasing the mortality rate for many different infectious diseases (Ventola, 2015). Unfortunately, infections now are getting harder to overcome because overuse of antibiotics is leading to resistance in many common pathogens. As an introductory biology study, I was able to do my own research on antibiotic discovery through the Small World Initiative (SWI). The SWI is a global group of undergraduate collaborators working together to solve the antibiotic crisis through discovery of antibiotic producing bacteria (Hernandez, 2015). SWI provided the foundation for our course-based research experience that could help us discover new antibiotics to fight resistant pathogens. In my research, I searched for antibiotic producing bacteria from soil in my back yard in Mt. Emmons, Utah. I isolated 24 different species on 10 % TSA medium and used a spread/patch bioassay to screen them for antibiotic production against safe relatives of pathogens that commonly develop resistance. I picked four isolates that demonstrated antibiotic activity. The 16sRNA gene from one of those isolates was amplified and sequenced. I used a bioinformatics tool (BLAST) to align my sequence to the closest known DNA sequence. The results for my BLAST search and Gram staining are consistent with my isolate Brevibacillus laterosporus, or a closely related species. Works Cited Hernandez S, et al. Small World Initiative: Student Research Guide, Second Edition, 2015, Center for Scientific Teaching, Yale University. Ventola C. Pharmacy and Therapeutics: The Antibiotic Resistance Crisis, Part 1, 2015. Volume 40. Pages 277-283.

# Determining the Mechanism of Cocoa-Derived Epicatechin Enhancement of Glucose Stimulated Insulin Secretion

Benjamin Bitner (Brigham Young University); Tommy Rowley (Brigham Young University); Matt Ballard (Brigham Young University); Justin Bosley (Brigham Young University); Jeffery Tessem (Brigham Young University)
*Faculty Mentor: Jeffery Tessem*

Due to recent increases in incidence, diabetes is now classified as a global epidemic. Diabetes results from the eventual destruction of β-cell mass, which causes decreased insulin secretion. Increasing functional β-cell mass may provide a cure for diabetes. A previous study has shown that oligomeric cocoa procyanidins were effective in preventing weight gain, fat mass, impaired glucose tolerance, and insulin resistance in a mouse obesity model. This was the first long-term feeding study to examine the activities of cocoa constituents on diet-induced obesity and insulin resistance. Our research suggests that these outcomes are results of β-cell proliferation, enhanced glucose stimulated insulin secretion (GSIS) and decreased apoptosis. My research demonstrates that cocoa epicatechin monomers (CEM) enhance GSIS in β-cells. This indicates that CEM may positively modulate pathways in mature β-cell function leading to enhanced insulin secretion. We present a model by which CEM enhances GSIS in β-cells.

# The influence of social support on health outcomes in the older population

Jerry Bounsanga (University of Utah); Man Hung (University of Utah); Maren Voss (University of Utah); Anthony Crum (University of Utah); Wei Chen (University of Utah); Wendy Birmingham (Brigham Young University)
*Faculty Mentor: Man Hung*

Objectives: Arthritis is one of the leading aging-related health problems in the United States. Family support has been shown to improve chronic conditions but studies are lacking in identifying its association with pain and depression for arthritic conditions. Therefore, this study aims at exploring whether family support is associated with pain and depression in older adults with arthritis. Methods: Age, ethnicity, gender, marital/educational status and employment/income, physical function/disability status, pain and antidepressant medications, and other clinical indicators of chronic health conditions were controlled for to examine the effects of family support (spouse, children, other) on pain and depressive symptoms using logistic regression. Results: Drawn from the 2012 Health and Retirement Study (HRS), the total cross-sectional sample consisted of 844 males (35.0%) and 1,567 females (65.0%) with arthritic conditions (n = 2,411) who had an average age of 76.0 years. Positive and negative family support were significantly associated with depressive symptoms but not with pain. Support from a spouse was significantly associated with depressive symptoms. Discussion: Overall our results suggest that with higher positive family support, depressive symptoms and pain were more likely to decrease among individuals with arthritis. In addition, our results indicated that both pain and depressive symptoms were more likely to increase when higher levels of negative family support were present.

# Medicare Part B Utilization and Payment: A National Study of Family Practice Providers

Jerry Bounsanga (University of Utah); Maren Voss (University of Utah); Anthony Crum (University of Utah); Man Hung (University of Utah)
*Faculty Mentor: Man Hung*

Objectives: Many older adults in the United States are relying on Medicare Part B to pay for necessary medical expenses related to family practice services as healthcare costs are increasing. The purpose of this study is to describe Medicare Part B utilization and payment among family practice providers in 2012 and to examine patterns in the delivery of care and reimbursement rates to providers. Study Design: Using the Medicare Part B Utilization and Payment Data released by the Center for Medicare & Medicaid Services, we examined the average allowed amounts, average submitted charges, average payments, and procedures across various regions in the US. Methods: Descriptive statistics were compiled for averages, means, and standard deviations of medical procedures, charges, and reimbursements across regions. One-way ANOVA were computed using SPSS version 22 and p-values less than .05 were considered significant. Results: The study included a total of 77,462 family practice providers with 969,353 procedures performed. There was a significant difference in Medicare Part B average allowed amounts, submitted charges, and payments across regions. Large regional differences in types of procedures performed were also noted. Conclusions: This study represented one of the first opportunities to explore Medicare Part B provider utilization and payment for family practice physicians. Lower reimbursement was related to higher number of medical procedures performed. This research suggests that regional variation in medical procedures performed may assist future research concerning disparities in family practice care access and billing.

# Determination of treatments to reduce late gassy defect in cheese due to Lactobacillus wasatchensis WDC04 contamination

Isaac Bowen (Weber State University); Craig Oberg (Weber State University); Michele Culumber (Weber State University)
*Faculty Mentor: Craig Oberg*

Lactobacillus wasatchensis WDC04 is a newly discovered obligately facultative lactic acid bacterium isolated from gassy Cheddar cheese. Previous research has associated WDC04 with late gassy defect in aged cheese, which causes serious commercial losses from bloated cheese packages and textual defects. Experiments were performed to determine its salt tolerance at pH 5.2 and 6.5, resistance to HTST pasteurization, and pH growth range. Understanding the growth characteristics of Lb. wasatchensis WDC04 could allow some manipulation of the cheese environment to control it. MRS with 1.5% ribose (MRS-R) was prepared at either pH 5.2 or 6.5 with salt concentrations ranging from 0.0%-10.0%. Two ml of the MRS-R test media was added to each well in a 24 micro-well plate and a pre-inoculated absorbance reading was taken at 600 nm. Immediately after, 100 microliters of WDC04 was added to each well and incubated at 25 degrees C for 3 d (pH 6.5) or 2 d (pH 5.2). Plates were then placed in a Teacon Infinite 2000 with absorbance readings (A600) taken every 4 h for 24h. Results showed WDC04 grew best in 3.0% salt (pH 6.5) and 2.0% salt (pH 5.2) but showed some growth up to 6% at either pH. Further testing was performed using a narrower salt concentration range (5.25%-6.75%) at pH 6.5 to determine if a salt concentration used in cheese could suppress WDC04 growth. The same protocol was followed with the micro-well plate incubating for 3 d before absorbance readings were taken. Above 6.0% salt WDC04 was inhibited and ceased to grow. Using the same methodology, the pH range (2-8) for WDC04 was also determined. Results confirmed WDC04 grew best at pH 5-6 (cheese pH) but did not grow below pH 4 or above pH 7. A heat shock experiment was performed to model HTST pasteurization. WDC04 was grown in MRS-R broth for 2 d and diluted, then heat shocked in a hot water bath at 72 degrees C for 15 sec and plated. With an initial count of 108 CFU/ml, results showed a decrease of 105CFU/ml in survival of WDC04, indicating WDC04 could be contaminating the cheese by surviving pasteurization if it is at high levels in the milk. These results suggest using a higher salt/moisture ratio in cheese and increasing pre-pasteurization sanitation to remove biofilms would decrease the likelihood of Lb. wasatchensis WDC04 in ripening cheese, thus, reducing the possibility of late gassy defect.

# Prevalence and Impact of Sexual Assault on those with Mental Illness: A Retrospective Study

Holden Brimhall (Brigham Young University); Kelsie Pead (BYU); Leslie Miles (BYU); Linda Mabey (BYU); Julie Valentine (BYU)
*Faculty Mentor: Leslie Miles*

Title: Prevalence and Impact of Sexual Assault on those with Mental Illness: A Retrospective Study Authors: Holden Brimhall, BS Student; Kelsie Pead, SN; Leslie Miles, DNP, APRNBC; Linda Mabey, DNP, APRN- BC; Julie Valentine, PhD(c), RN, CNE, SANE-A Central Research Question: Are those with mental illness at greater risk for sexual assault? Purpose: National research has demonstrated that men and women with severe mental illness (MI) are more likely to be sexually assaulted (Grubaugh et al., 2011). The purpose of this study was to determine the following in victims of sexual assault: prevalence of MI; psychotropic drug use; previous history of sexual assault; pre-existing medical conditions; and submission rates of sexual assault kits (SAKs). Data was collected from 2010-2013 Sexual Assault Nurse Examiner (SANE) reports from Salt Lake County and compared with state and national statistics. Methodology: Setting: Salt Lake County Sample: 1350 SANE reports from victims age 14 and older Instruments: Retrospective chart review with prevalence of MI, psychotropic drug use, previous history of sexual assault, pre-existing medical conditions in victims of sexual assault with MI, and submission rates of SAKs coded using SPSS. Procedures: Retrospective chart review Data analysis: Researchers evaluated self-reported medications to determine if medications were used for probable psychiatric illnesses. Psychotropic medications were categorized according to drug classes. Descriptive data compiled on identified variables of interest and chi square analysis completed to evaluate the association between self-disclosed MI and use of psychotropic medications with SAK submission. Findings: Significantly higher rates of psychotropic medication use were found in sexual assault victims than in the general population. Prevalent psychiatric illnesses were categorized. Rate of SAK submission to crime labs and history of prior sexual assault will be reported. Implications: • Increase health provider and law enforcement awareness of risk of sexual assault in individuals with MI • Identify community resources for evidenced-based post trauma mental health care • Consider the implementation of a separate health information form, not to be submitted to law enforcement with SAK paperwork Conclusions: The prevalence of sexual assault against victims with MI suggests many implications for healthcare providers and law enforcement officials, including enhanced treatment for victims, increased community education, and improved awareness of the effects of sexual assault. Citations: Grubaugh, A. L., Zinzow, H. M., Paul, L., Egede, L. E., & Frueh, B. C. (2011). Trauma exposure and posttraumatic stress disorder in adults with severe mental illness: A critical review. Clinical Psychology Review, 31(6), 883-899. doi:10.1016/j.cpr.2011.04.003

# Somatic Symptom Disorder in DSM-5: Misdiagnosing Biological Causations of Mental Illness and Devaluing the Functionality of Pain

Ashleigh Brinkerhoff (Dixie State University)
*Faculty Mentor: John Pugliese*

In primary care settings, somatic symptom disorders (SSD) are currently the most diagnosed mental health category. Many of these outpatients endure chronic pain, and 50% experience medically unexplained symptoms (MUS). The newly reconceptualized chapter for somatic symptoms in DSM-5 constitutes that SSD can now be diagnosed depending upon the ways patients interpret and describe ongoing symptoms. Enduring pain and chronic illness are known to perpetuate maladaptive behaviors, inducing desperate attempts to seek validation, and may precipitate the misdiagnosis of SSD. Additionally, the reorganization of DSM-5 SSD was motivated by the intention to increase diagnostic convenience for nonpyschiatric, and primary care clinicians. The aims of this research demonstrate how clinicians in outpatient medical settings are overdiagnosing SSD according to current DSM-5 criterion, and failing to accurately assess several underlying biological principles of mental disorders, including those with genetic, cognitive, and neural components. The functionality of MUS and chronic pain are insufficiently stimulating proper medical intervention, and predominantly serve as preceding factors for the misdiagnosis of mental illness. The implications for these findings suggest that diagnostic parameters for mental health deserve more precision, thus clinicians could more effectively rule out underlying biological causations when patients progressively suffer. Such efforts would improve the patient-doctor relationship and enhance patient outcomes.

# Person Specific Control System for Adaptive Equipment in Recreational Therapy

Nicolas Brown (University of Utah); Andrew Merryweather (University of Utah); Matthew Koplin (University of Utah); Paige DaBell (University of Utah); Keith Schendel (University of Utah); Jeffery Rosenbluth (University of Utah)
*Faculty Mentor: Andrew Merryweather*

INTRODUCTION: The involvement of persons with high-level spinal cord injury (HL-SCI) in recreational therapy is limited by a lack of properly engineered equipment. Adapted recreational equipment for HL-SCI patients often requires appropriate control systems that are easily tailored to an individual's injury level and function. For example, it is not appropriate to use a sip and puff control system when a patient has complete or partial upper body control. SCIs do not present the same between individuals. Function is largely influenced by location and completeness of the injury. This presents a major challenge in designing adaptable recreational equipment for individuals with HL-SCI. One of the greatest challenges in adapting recreational equipment for individuals with HL-SCI is the level of customization required for each design. Historically, this has resulted in equipment that is prohibitively expensive. In an effort to address these challenges, researchers in the Department of Mechanical Engineering have partnered with the Therapeutic Recreation and Independent Lifestyles (TRAILS) Program of the Rehabilitation Center at the University of Utah Health Care center. METHODS: A downhill all-terrain wheelchair (Mountain Chair) was created and evaluated for users with an injury at the 6th cervical vertebrae (C6). Functional limitations include partial/complete paralysis in the hands, legs, and trunk and degraded wrist flexion, and paralysis in the triceps. Wrist extension and bicep function is only partially affected. The C6 control system design takes advantage of wrist extension by evaluating user function and setting range of motion values as end points. Next, wrist position information is fed back to a central control system to manage the proportional Smart Brake System (SBS). Directional control is accomplished using only biceps. A head-switch engages a drive motor when necessary to maneuver obstacles or travel up hill. A Bluetooth based remote control provides a companion with full override of the smart brake system in case of emergency. DISCUSSION: The modifications and control strategy developed through this work enables individuals with HL-SCI full control over recreational equipment. A Sit-Ski, Sailing Kayak and Recumbent Bike are all undergoing transformation to accept derivations of this common control system. Research shows that recreational therapy increases independence and quality of life and includes benefits during transition from injury recovery to injury adaptation. Giving control at the injury level improves natural reflexes and gives the patient a feeling of independence again.

# Innovative Engineering to Improve the Quality of Life for Individuals with High Level Spinal Cord Injury

Nicolas Brown (University of Utah); Andrew Merryweather (University of Utah); John Lilquist (University of Utah); Ross Imburgia (University of Utah); Jeffrey Rosenbluth (University of Utah)
*Faculty Mentor: Andrew Merryweather*

INTRODUCTION: It is well known and documented that individuals with traumatic spinal cord injuries (SCI) experience a decline in their quality of life. An increase in depression, anxiety, and irritability is common among the majority of individuals with SCI. One reason for these changes is the loss of independence in both day-to-day and extracurricular activities. Research suggests that patients with SCI who become involved in recreational activities experience a positive change in attitude. Studies show recreational rehabilitation improves mood, combats depression, and increases the feeling of a higher quality of life. Therapists recommend recreation rehabilitation begin as soon as possible to combat changes in mood. While recreational equipment is widely available for individuals with low-level SCI, high-level SCI (HL-SCI) patient recreation equipment is limited. The majority of outdoor recreation equipment available to HL-SCI patients consists of passive equipment such as running pushchairs, rather than an active experience where the user is in control of the equipment. There is significant need for adaptive equipment that allows greater independence to individuals with HL-SCI. METHODS: Researchers in the Department of Mechanical Engineering have partnered with the Therapeutic Recreation and Independent Lifestyles (TRAILS) Program of the Rehabilitation Center at the University of Utah Health Care center to answer the call to create an adaptive control framework to interface with recreational therapy equipment already in use. Using a modeling-prototype-feedback approach between patients, therapists, and SCI specialists, the research team has developed a system to bridge the gap between patients and devices to allow patients with SCI the ability to control recreational equipment. The system consists of a microcontroller and hardware interface that provides patients with a customizable solution with quasi-independent control. These improvements stem from a newly created sip and puff system which allows recreational equipment limitless input and customization for each user, depending on his/her abilities. Other features include compatibility with existing technology, such as wheelchair joystick controls, and wireless therapist override to allow safe equipment operation in the event of a patient emergency. DISCUSSION: As medical advances increase survivability of HL-SCI, it is imperative that HL-SCI patients have the opportunity to participate in activities similar to those enjoyed before their injuries. Providing a system that enables independence and customization to interface with recreational equipment significantly improves participation. With the new sip and puff technology, HL-SCI patients can enjoy the same activities as friends and family in a recreational setting, which improves sociability and quality of life. Beyond recreation equipment, advances in this field can be adapted to control devices used for day-to-day situations, such as using a computer, watching TV, opening doors, and using other household appliances.

# A Framework for Validating Modeled Air Quality Data in Health Research

Nicole Burnett (University of Utah); Peter Mo (University of Utah); Naresh Rajan (University of Utah); Randy Madsen (University of Utah); Ram Gouripeddi (University of Utah); Julio Facelli (University of Utah)

*Faculty Mentor: Ram Gouripeddi*

Background In the Salt Lake Valley there are three permanent Environmental Protection Agency (EPA) certified air quality monitoring stations that intake air samples and produce results of the air quality in the proximity of the monitor station. Due to the fact that the monitors only represent a small area of the 500-square-mile Salt Lake Valley, there are spatial gaps when using the air quality monitoring data for epidemiological studies. Since for certain studies health researchers may require a higher resolution spatio-temporal air quality grid [1], we need to devise new approaches to provide air quality data that could meet the epidemiological studies requirements. Research Methodology Modeled air quality data available from the EPA, has higher spatial and temporal resolution than data from monitoring stations, but it needs experimental validation and uncertainty quantification (UQ) in the Salt Lake Valley. We can achieve these validation and UQ goals through statistical comparisons of measured air quality data at the same location and time as the modeled air quality data. The air quality model that we primarily used is the one that the EPA has developed for the Centers for Disease Control and Prevention's (CDC) National Environmental Public Health Tracking Network [2]. This is a model that uses a Hierarchical Bayesian Space Time Modeling approach [3]. This model was validated on the east coast of the United States so it is unknown how effective is in taking into account the terrain of the Salt Lake Valley. Modeled PM2.5 data in a 12x12 kilometer continuous grid resolution for the years 2007 and 2008 were compared against measured data of the same timeframe and location. The measured data was obtained from EPA's Air Quality System (AQS) Datamart [4]. The statistical comparisons performed using these the two data sets were done using daily and monthly PM2.5 averages for the years 2007 and 2008 using MySQL, MATLAB and R. Conclusion & Significance We have developed a prototype for comparing and validating modeled air quality data against measured air quality data for the Salt Lake Valley. We found the modeled data fits the measured data fairly well. We will expand our work by developing a validating framework that will include a library of data modeling algorithms such as, The Complex Terrain Dispersion Model Plus Algorithms for Unstable Situations (CTDMPLUS) [5] and Yanosky's [6], which could be selected by the user. The framework will be developed using OpenFurther, and then integrated with biomedical data [7]. The framework will be integrated into the PRISMS project [8] as part of the informatics infrastructure for studying the effects of air quality on pediatric asthma. References [1] M. Z. Al-Hamdan, W. L. Crosson, A. S. Limaye, D. L. Rickman, D. A. Quattrochi, M. G. Estes, J. R. Qualters, A. H. Sinclair, D. D. Tolsma, K. A. Adeniyi, and A. S. Niskar, "Methods for Characterizing Fine Particulate Matter Using Ground Observations and Remotely Sensed Data: Potential Use for Environmental Public Health Surveillance," J. Air Waste Manag. Assoc., vol. 59, no. 7, pp. 865-881, Jul. 2009. [2] "Air Quality Data for the CDC National EPHT Network | Human Exposure and Atmospheric Sciences | US EPA." [Online]. Available: http://www.epa.gov/heasd/research/cdc.html. [Accessed: 18-Sep-2014]. [3] N. J. McMillan, D. M. Holland, M. Morara, and J. Feng, "Combining numerical model output and particulate data using Bayesian space-time modeling," Environmetrics, p. n/a-n/a, 2009. [4] "AirData | US Environmental Protection Agency." [Online]. Available: http://www3.epa.gov/airdata/index.html. [Accessed: 20-Oct-2015]. [5] Environmental Protection Agency, "Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose." Environmental Protection Agency, 09-Nov-2005. [6] J. D. Yanosky, C. J. Paciorek, F. Laden, J. E. Hart, R. C. Puett, D. Liao, and H. H. Suh, "Spatio-temporal modeling of particulate air pollution in the conterminous United States using geographic and meteorological predictors," Environ. Health, vol. 13, no. 1, p. 63, Aug. 2014. [7] R. Gouripeddi, N. Sundar Rajan, R. Madsen, P. Warner, and J. C. Facelli, "Federating Air Quality Data with Clinical Data," presented at the 2014 AMIA Annual Symposium Proceedings, 2014. [8] "Pediatric Research Using Integrated Sensor Monitoring Systems | National Institute of Biomedical Imaging and Bioengineering." [Online]. Available: http://www.nibib.nih.gov/research-funding/prisms. [Accessed: 20-Oct-2015]. Acknowledgements Grants: UU Air Quality Program, U54EB021973, NCRR/NCATS UL1RR025764, 3UL1RR025764-02S2, AHRQ R01 HS019862, DHHS 1D1BRH20425, UU Research Foundation. CHPC at UU.

# Perceptions of Violence Against Women Among College Students in the US, Japan, India, Vietnam, and China

Margaret Carlson (University of Utah)
*Faculty Mentor: Akiko Kamimura*

Description of Problem and Objectives: Violence against women is a global health issue that threatens the health and human rights of women. Intimate partner violence (IPV), which includes physical, sexual, or psychological harm, and sexual violence are the most common forms of violence against women. While previous studies examined incidence of IPV and other forms of violence against women, little is known about variations in the perceptions of violence against women among college students in other countries. This study explored differences in perception of violence against women among college students in the US, Japan, India, Vietnam and China. The different backgrounds of the legal systems and cultures may be associated with national differences in perception of violence against women. This study targeted college students because this is a cohort that has the potential to change the future. Better understanding of national differences in perception of violence against women is important to develop culturally and country-specific effective violence against women prevention programs. Method and Results: A total of 1,136 college students from these countries- one university from the US, two universities in Japan, one university in India, Vietnam, and China, participated in a self-administered survey in 2012-2013. Student's ages ranged from 18-30 years. The students' perception about prevalence of domestic violence is in their country varied across countries. Furthermore, more than half of the students across the countries perceived alcoholism and drug addiction to be causes of domestic violence against women. It was also found that the levels of knowledge about laws on domestic violence in their country varied among the students and did not portray the actual legal situation. This included students whose countries had laws enacted to protect victims of violence. Conclusion: These findings show the importance of understanding country level variations that may affect violence against women. Even though there were some similarities, this study showed great differences among the countries, suggesting that possible underlying socio and cultural factors may have a hand in determining these perceptions. The results of this study provide important insights by documenting cross country variations in students' perceptions about violence against women that can provide helpful inputs in framing country-specific programs and policies to prevent violence against women.

# Differentiation of iPSCs into cardiomyocytes utilizing extracellular matrix

Arthur Castleton (Brigham Young University); Donnie Feifer (Brigham Young University); Kaitlyn Johnson (Brigham Young University); Brady Vance (Brigham Young University); Michael Stewart (Brigham Young University); Ryan Goodman (Brigham Young University); Matthew Zimmerman (Brigham Young University); Joseph Bloxham (Brigham Young University)
*Faculty Mentor: Alonzo Cook*

Heart disease is the global leading cause of death; the number of needed donor hearts grows daily while the quantity of available donor hearts remains stagnate. Developing patient-specific heart patches is a promising response to the mounting need of new and more effective therapies for patients with heart disease. Prior literature has demonstrated that mouse hearts can be decellularized, recellularized with murine cells, and with electric stimuli, begin to beat. In this study, pig hearts and bladders, which are comparable in size and anatomy to their human counterparts, were harvested from a local abattoir, and decellularized in an automated perfusion bioreactor utilizing PBS, Type 1 water, sodium dodecyl sulfate (SDS), and Triton X-100. Hearts were then dissected and sectioned into 1 cm diameter and 200 μm tall samples and human induced Pluripotent Stem cells were seeded onto the specimens. Cells were observed to infiltrate and adhere to the protein scaffold. After approximately 2 weeks of incubation the bioartificial human cardiac tissue began to pulse. Electrical stimuli was applied to the samples and the strength of contracture was measured. This study marks a promising milestone in the development of bioartificial tissues and organs.

# The Human Microbiome

Annwin Chen (University of Utah)
*Faculty Mentor: Amy M. Barrios*

There are millions of bacteria. Humans are a habitat for just a fraction of them. However, that small portion of bacteria influences many functions of the human body, one of those being the metabolic pathway for diets and medicine. Many gut bacteria have been identified. Yet, there is little understanding of the activities of the human microbiome. Research has shown that artificial sweeteners give a higher risk to glucose intolerance because the composition of the bacteria in the gut (1). Gut bacteria also play a critical role in drug metabolism, predominantly through reductive and hydrolytic reactions (2). For instance, 5-Aminosalicylic acid (5-ASA) is a common active ingredient in prodrugs: mesalazine, sulfasalazine, balsalazide and olsalazine. Bacterial azoreductase enzymes in the gut convert these prodrugs into the active component, 5-ASA (3). Although bacterial enzyme activity is important in maintaining human health, there is no current way to easily monitor their activities in complex microbial samples. In this project, we are working to create a panel of fluorogenic enzyme substrates that can be used to identify active bacterial enzymes. There is a panel of substrates tested with the sample and against their own set of controls. According to the bacteria present, there should be different substrates that become fluorescent because their R groups have been hydrolyzed or reduced. A trial has been done on Align (Bifidobacterium infantis) and it had certain substrates that became fluorescent. The bacterial samples are from Dr. Round's lab Department of Pathology at the University of Utah. Unique profiles are already seen with different bacterial strains. There is no current way to simply assess what microbiome is present and what it does. The ability to detect bacterial enzyme activities is complementary to existing methods that identify the strains present in a bacterial sample, which will be very valuable to the field.

# Body mass index and risk of head and neck cancer

Yuji Chen (University of Utah); Mia Hashibe (Department of Family and Preventive Medicine, University of Utah School of Medicine, Salt Lake City, UT); Yuan-Chin Amy Lee (Department of Family and Preventive Medicine, University of Utah School of Medicine, Salt Lake City, UT); Shuang Li (Division of Public Health, Department of Family and Preventive Medicine, and Huntsman Cancer Institute, University of Utah School of Medicine, Salt Lake City, UT,USA); Zuo-Feng Zhang (Department of Epidemiology and Center for Environmental Genomics, Fielding School of Public Health, Los Angeles, CA); Min Dai (National Office of Cancer Prevention & Control Cancer Institute & Hospital, and Chinese Academy of Medical Sciences, Beijing, China); Qian Li (Department of Preventive Medicine, Icahn School of Medicine at Mount Sinai, New York, NY); Chien-jen Chen (Genomics Research Center, Academia Sinica, and Graduate Institute of Epidemiology and Preventive Medicine, National Taiwan University, Taipei, Taiwan); Wan-Lun Hsu (Genomics Research Center, Academia Sinica, Taipei, Taiwan); Pen-Jen Lou (Department of Otolaryngology, National Taiwan University Hospital, Taipei, Taiwan); Cairong Zhu (Department of Epidemiology and Biostatistics, West China Center of Medical Sciences, Sichuan University, Sichuan, China); Jian Pan (Department of Oral Surgery, West China Hospital of Stomatology, Sichuan University, Sichuan, China); Hongbing Shen (Department of Epidemiology and Biostatistics, Jiangsu key lab of Cancer Biomarkers, Prevention and Treatment, Collaborative Innovation Center for Cancer Personalized Medicine, School of Public Health, Nanjing Medical University)
*Faculty Mentor: Mia Hashibie*

Abstract Background. Most of the previous large-scale studies investigating body mass index (BMI) and head and neck cancer (HNC) risk have focused on European- origin populations. The aim of our study was investigate potential associations between BMI and HNC risk and whether these associations differ for specific subgroups of individuals such as never tobacco smokers. Methods. We conducted a multicenter case-control study in East Asia (Beijing, Fujian, Henan, Jiangsu, Liaoning, Shanghai, Sichuan, and Taiwan) including 921 cases and 806 controls. We estimated the adjusted odds ratios (ORs) and 95% confidence intervals for HNC risks by using logistic regression. We adjusted for age, ethnicity, education, center, daily cigarettes per day, cigarette years, alcohol drinks per week, alcohol years, betel quid chewed per day and betel years. Results. Compared to normal body mass index (18.5≤BMI<25 kg/m2), low BMI (0<BMI<18.5 kg/m-2) was associated with higher HNC risk (OR=2.71, 95% CI=1.40-5.26). Additionally, high BMI (BMI>30 kg/m2) was associated with lower HNC risk (OR=0.3, 95% CI=0.16-0.57). Being underweight at age 20 was also associated with an increased risk of HNC (OR=1.51, 95%CI=1.02-2.24). For analysis by subsites, BMI at age 20 was not associated with the risk of oral cavity, oropharynx, hypopharynx or laryngeal cancers. Ever smokers and both never and ever drinkers had a increased risk of HNC for low BMI (0<BMI<18.5 kg/m-2) and reduced risk of HNC for high BMI (BMI>30 kg/m2). Also BMI decreasing over an individual's lifetime (BMI decrease of ≤10%) was associated with higher HNC risk. However, BMI gain over time showed no overall association with HNC. There was an 8% reduction in risk of HNC with every 5kg/m2 increase in BMI at interview. Risk of HNC decreased by approximately 15% and 14% for every 5kg/m2 with ever smokers and ever drinkers. For every 5kg/m2 increase in BMI at age 20, there was a reduction in HNC risk. Although height in quartile distribution was not associated with the risk of HNC, there was a 2% reduction in risk of HNC with every 5cm increase in height. Height was associated with decreased risk of oral cavity cancer (OR=0.51, 95% CI=0.28-0.93). Conclusion. Low BMI was associated with increased HNC risk and high BMI was associated with reduced HNC risk, which is consistent with other studies in other regions. The low BMI - higher HNC risk association held even for BMI at age 20. Future studies including anthropometric measures such as waist-to-hip circumference may be of interest for HNC risk is an Asian population. Keywords: BMI, head and neck cancer

# Identification of a new blood-born bacteria in the human body

Adriana Christenen (Dixie State University); Donald Warner (Dixie State University)
*Faculty Mentor: Donald Warner*

A new species of bacterium was isolated from a clinical specimen that was studied by phenotypic, chemotaxonomic, and genetic characterization. This strain had characteristics consistent with those of Bacillus licheniformis; however, 16S rRNA sequencing indicates that this strain belongs to a new species. This bacterium is a gram negative, endospore forming, motile bacillus; it is also hemolytic. This bacterium was isolated from a blood specimen that was collected from a human, who was diagnosed with anemia.

# Sexual Trauma, Touch Apprehension, and Relationship Quality in Women Military Sexual Trauma Survivors

Danielle Christensen (Utah State University); Rebecca K. Blais, PhD (Utah State University)
*Faculty Mentor: Rebecca K. Blais PhD*

According to VA screening data, 25% of women Veterans report military sexual trauma (MST; VA, nd). MST is highly correlated with PTSD. In fact, MST is more likely to cause PTSD than deadly combat experiences (Galbreath, 2015). PTSD severity is negatively related to relationship quality, which is problematic as relationship quality buffers against PTSD and dysfunction secondary to PTSD. Relationship quality is multidimensional and includes satisfaction with physical touch; the effects of sexual trauma on touch apprehension have not been examined in those with MST. Moreover, it is not clear whether contact MST (e.g., rape) and non-contact MST (e.g., verbal harassment) differentially relate to touch apprehension and relationship quality. Findings from this line of research could provide helpful insights into ways to improve individual and couple-level interventions to address PTSD and MST. The current study examined the association of MST type (contact/noncontact), PTSD severity, touch apprehension, and relationship quality in 389 partnered women Veterans who reported a history of MST. The majority of the sample (71.72%) reported contact MST. Bivariate analyses revealed that higher touch apprehension was negatively associated relationship quality ($r=-.19$, $p<.01$) and PTSD ($r=-.42$, $p<.001$), and touch apprehension was higher in Veterans who reported contact MST ($M=36.76$, $SD=9.28$) vs. noncontact ($M=41.76$, $SD=9.33$) MST (higher scores indicate lower touch apprehension). In a step-wise regression accounting for demographic risk factors, PTSD was associated with lower relationship quality (partial $r=¬-0.24$, $p<.01$). Touch apprehension and MST type were nonsignificant. These findings suggest that distinguishing between type of MST (e.g., contact vs noncontact) and assessing touch apprehension may be useful when studying or treating MST. Though neither predicted relationship quality after accounting for PTSD, such measures provide helpful information that contributes to a more complete clinical understanding.

# Cooperative Primers : Intersecting Spherical Model for Optimization of Linker and Gap Lengths

Masen Christensen (University of Utah)
*Faculty Mentor: Saveez Saffarian*

Cooperative Primers, a new class of PCR Primer technology invented by Dr. Brent Satterfield, virtually eliminate primer dimers while maintaining specificity. They consist of a primer and a capture sequence connected by an inert linker. When the capture sequence anneals, the primer is brought into artificially close proximity with its target, thus increasing the local concentration of the primer (Pl) by approximately 1,500X. This allows the primer to be synthesized with a very low Tm (approx. 20C below reaction temperature) while still amplifying in PCR reactions. Cooperative Primers show promise in the fields of SNP detection, low-cost diagnostic PCR, and multiplex PCR. However, little research has been done on their optimization. By accounting for additional effects caused by the flexibility of the target DNA sequence, DNA bonding angles, and asymmetries in the extension of the polymerase, I have reformulated the equations used to maximize the Pl. Using these equations, we have changed the way we make Cooperative Primers to increase the Pl by 20,000X over original reaction concentrations - an order of magnitude improvement over previous design methods. Experimental results compare favorably to predictions - especially in relation to previous models. Future research avenues are proposed.

# Emotional Hooks: The impact of photography in the media

McKade Christensen (Dixie State University); Nancy Ross (Dixie State University)
*Faculty Mentor: Nancy Ross*

The Syrian refugee crisis has been an on-going tragedy for over four years now. Up until September of 2015, the major nations of the world did not do much to address the upheaval in Syrian. Only after the release of a particular photo in the media have world leaders taken a larger stance on accepting more refugees and bringing attention to the crisis. This presentation examines how individuals respond when presented with different types of media including photographs, text, and political cartoons that relay similar kinds of information. I engaged in a class research project aimed at determining the power of photography and the emotions it activates within an individual. In our research we attempted to understand which types of media produced the strongest reactions in an individual's mind. We conducted a survey, gathering data from about 240 individuals spread across the United States and Europe. We asked demographic questions, and then had respondents write down their reactions to the different types of media we presented to them. We coded the responses into different themes to better understand the emotions felt during the viewing of the different media. Preliminary results indicate that photography has a unique impact on media viewers that is greater and different from political cartoons and text. Going forward with the data analysis, I will be able to calculate the strength of each type of media and see which specific emotions are reported by different demographic categories. I think that the data will show that photography is universally preferred as a means of communication. Photography is a unique medium which can relay raw, visual information to a viewer that writing cannot. Photography has the ability to transform a distant viewer into a front row observer.

# Phantom Results Strongly Correlate to a 73-Patient High-Frequency Ultrasound Study of Breast Cancer Surgical Margins

Zachary Coffman (Utah Valley University); Nicole Cowan (Utah Valley University); Robyn Omer (Utah Valley University); Timothy E. Doyle (Utah Valley University)
*Faculty Mentor: Timothy E. Doyle*

Breast density is typically determined using mammography, and describes the proportion of connective tissue versus fat tissue in the breast. Women with higher breast density are four to five times more likely to develop breast cancer than women with lower breast densities. Additionally, higher breast densities have proven to make current breast cancer imaging and detection more difficult. Surgical studies performed in collaboration between Utah Valley University and the Huntsman Cancer Institute show that high-frequency (HF) ultrasound (20-80 MHz), and the parameters peak density (number of spectral peaks and valleys in the 20-80 MHz range) and attenuation, are sensitive to breast tissue pathology. These studies also showed that breast density had no effect on peak density across the entire breast density range while attenuation increases two times from entirely fat to extremely dense. The objective of these studies was to determine the effect of breast density on HF ultrasound wave propagation using phantoms that mimic the histology of breast tissues. Phantoms were created from distilled water, agarose powder, 10X TBE stock solution, polyethylene microspheres and polyethylene fibers to simulate breast tissue histology. In one experiment, microsphere size (90-106µm diameter) was kept constant while weight percent (0.00-0.06g) was varied in the experiment. In another experiment, fiber size was kept constant while weight percent (0.00-0.06g) was varied. In a third experiment, a combination of polyethylene microspheres and fibers were used to more accurately model breast tissue histology. Pitch-catch measurements were acquired using 50-MHz transducers, a HF pulser-receiver, a 1-GHz digital oscilloscope, and glycerol as the coupling agent. Peak density showed no trend or significant change with increasing breast density, whereas attenuation showed sensitivity to the total weight percent of scatterers. The phantom results confirm that peak density is insensitive to breast density whereas attenuation increases with greater breast density. The phantom results validate the results seen in the surgical studies.

# Micro-Tumor Detectability Studies using Histology Mimicking Phantoms: Evaluating the Sensitivity of High-Frequency Ultrasound to Breast Cancer

Nicole Cowan (Utah Valley University); Zachary Coffman (Utah Valley University); Robyn Omer (Utah Valley University); Benjamin Finch (Utah Valley University); Timothy Doyle (Utah Valley University)

*Faculty Mentor: Timothy Doyle*

The ability to differentiate between malignant and normal tissues in surgical margins during breast cancer surgery would reduce the risk of local recurrence and the need for subsequent surgeries to remove residual cancer. Surgical studies conducted in collaboration between Utah Valley University and the Huntsman Cancer Institute show that high-frequency (HF) ultrasound (20-80 MHz), and the parameters peak density (number of spectral peaks and valleys in the 20-80 MHz range) and attenuation, are sensitive to breast tissue pathology. Pathology results from these surgical studies showed that many margin specimens contained micro-tumors measuring 1 mm in diameter or smaller. The objective of this study was to determine the sensitivity of HF ultrasound to these micro-tumors using histology mimicking phantoms. Phantoms were created from distilled water, agarose powder, 10X TBE stock solution, and polyethylene microspheres to simulate breast tumors. Microspheres measuring 390µm-925µm diameters were embedded in the phantoms singularly and in clusters ranging from 3-12 microspheres. Pitch-catch measurements were acquired using large (low-resolution, 6.35mm diameter) and small (high-resolution, 1.5mm diameter) 50-MHz transducers, a HF pulsar-receiver, a 1-GHz digital oscilloscope, and glycerol as the coupling agent. Both large and small transducers were sensitive to single microspheres and microsphere clusters across all microsphere diameters. The phantom results confirm the sensitivity of high-frequency ultrasound to breast cancer micro-tumors and validate the surgical studies.

# Trends of depression across regions in the United States

Anthony Crum (University of Utah); Wendy Birmingham (Brigham Young University); Maren Voss (The University of Utah); Wei Chen (The University of Utah); Jerry Bounsanga (The University of Utah); Man Hung (The University of Utah)
*Faculty Mentor: Man Hung*

Objectives The prevalence of depression in older adults is fairly high and is associated with significant health care expenditures. Significant regional variations in some clinical conditions have been identified in past studies. However, there are limited studies exploring depressive symptoms across regions. This study aims to investigate the prevalence of depressive symptoms in older adults across different regions in the United States. Methods Northeast, Midwest, South and West census regions were categorized from participants' regions of residence. The presence of depressive symptoms were indicated by a composite score of 3 or greater from the Personal Health Questionnaire-2. Chi-square tests were used to analyze the proportion having depression across census regions. Results A total of 3,863 participants over the age of 65 were obtained from the 2011-2014 National Health and Aging Trends Study (NHATS) and were included in this study. Of those, 1,583 (41 %) were male, 2,757 (71.4%) were White, and 852 were between 70 and 74 years old at baseline (22.1%, n=852). Disparities in the prevalence of depressive symptoms were observed across different regions in the United States. From 2011 to 2014, depressive symptoms increased significantly in the Midwest and West ($p<0.05$) and significantly declined in the South ($p< 0.05$). Conclusion Improved treatment models and resource allocations may be possible by informing the public about regional variations of depressive symptoms in older adults. By exploring the prevalence of depressive symptoms across regions, there is an increased opportunity to appropriate funds to areas with the greatest need.

# Microbial Communities and Metabolic Potential in Sites of Continental Serpentinization

Emily Dart (University of Utah)
*Faculty Mentor: William Brazelton*

The geochemical process of serpentinization produces heat and organic carbon: two of the basic requirements needed to support life. Sites of active serpentinization in the deep subsurface provide the intriguing possibility of a non-photosynthetically supported biosphere. However, serpentinization also produces factors, such as high pH and limited electron receptors, which may limit microbial diversity. Gaining an understanding of the identity and metabolic potential of microbes that thrive in these environments may provide insight into whether serpentinization is sufficient to independently support life. Some sites of continental serpentinization create springs that feed surface pools. These pools provide easy access to deep subsurface fluids without the need for invasive sampling techniques such as drilling. However, the identification of microorganism associated with the subsurface is complicated by two factors, 1) contamination by surface microbes and 2) the presence of microbes that live in the transition zone where hydrogen-rich subsurface fluids meet oxygen-rich surface fluids. This study focuses on the isolation of subsurface microbes from a continental serpentinite spring in Gros Morne National Park, Newfoundland, Canada. To capture subsurface microbes, the pool was drained, surface fluid input was blocked, and DNA samples were taken from the subsurface source as the pool refilled. To study the richness and abundance of microbes present in the samples, 16S rRNA gene sequencing was carried out for both bacterial and archaeal 16S rRNA genes. Data analysis shows that the microbial makeup of subsurface fluids is significantly different than that of the pool prior to emptying and refilling. Erysipelotrichaceae are enriched in the pool post-refill whereas prior to refill the pool was enriched in Comamonadaceae ($p$-value$<0.05$). Shotgun metagenomic data is being used for both complete genome reconstruction and identification of gene pathways. These metagenomic results will help to more precisely test the possibility that these microbes are being supported solely by the geochemical serpentinization reactions.

# Use of CRISPR genome-editing technology to promote osteogenic differentiation in human adipose-derived mesenchymal stem cells (hAD-MSCs)

Bryton Davis (University of Utah); Niloofar Farhang (University of Utah); Robby Bowles (University of Utah)
*Faculty Mentor: Robby Bowles*

Spinal fusion surgery is used to treat an array of diseases and conditions. Spinal fusion removes the intervertebral disc between two vertebrae and fuses the vertebrae together. This is done to reduce excess vertebral motion via bone formation that bridges the vertebral bodies. With recovery times up to over a year and a success rate as low as 70%, advancements to this treatment option need to be made. The injection of osteogenically differentiated human adipose-derived mesenchymal stem cells (hAD-MSCs) into the fused vertebrae may help increase the success rate by enhancing its main goal of bone formation. hAD-MSCs are abundant, easily accessible, multipotent stem cells. However, due to their heterogeneity, naïve hAD-MSCs alone have not shown adequate osteoneogenesis. CRISPR (clustered regularly interspaced short palindromic repeats) genome-editing technology may be employed in order to enhance hAD-MSCs osteogenic potential and reduce their inherent heterogeneity. CRISPR technology harnesses bacterial adaptive immunity to produce sequence-specific targeting of genes in various cell lines. In order to promote osteogenic differentiation of hAD-MSCs, our goal is to replace a bone morphogenetic protein (BMP) antagonist with a BMP signaling agonist. BMPR1A is a BMP receptor that has been shown to promote hAD-MSCs osteogenic potential. Noggin is a BMP inhibitor that blocks the binding sites of BMP receptors and other signaling factors in the transforming growth factor-β (TGF-β) superfamily, rendering them ineffective. This leads to the inhibition of hAD-MSCs osteogenic potential. We proposed that, through the use of CRISPR technology, we could replace the noggin gene in hAD-MSCs with BMPR1A under noggin promotion. To do this, we replaced noggin with green fluorescent protein (GFP). GFP expression under noggin promotion was induced via BMP-2 dosing, which, in large concentrations, drives noggin expression. After these changes, BMP-2 was shown to induce GFP expression under control of the noggin promoter, but these cells were difficult to isolate. We then added to the GFP edit an UbC promotor, which drives constant gene expression, and a nuclear localization signal (NLS). This allowed for consistent GFP expression in the nucleus. We then sorted these cells via fluorescence activated cell sorting (FACS), which demonstrated successful edits in 7% of the cell population. To date, we have shown successful edits of the noggin gene and an ability to replace noggin with the gene of our choice. Ongoing work will replace GFP with BMPR1A. Again, we'll sort via FACS, but select for non-fluorescence instead. Following these edits, we will access osteogenic potential of these edited cells by exposing the cells to a range of BMP-2 dosing in culture, and measuring by alkaline phosphatase/alizarin red staining and qPCR the Runx-2, osteopontin and osteocalcin genes.

# Acute and Chronic Effects of Selenium on the Brine Shrimp Artemia franciscana

Jessica deJong (Weber State University)
*Faculty Mentor: Nicole Berthelemy*

The Great Salt Lake (GSL) is a terminal lake where selenium and other compounds accumulate. These toxins are discharged by incoming rivers and local mining operations. As the only outlet is evaporation, these solutes increase in concentration. Selenium is toxic to many living things in high amounts and has been found to cause birth defects in birds and mammals. Previous studies of selenium within the GSL ecosystem have focused on bioaccumulation within birds that feed on GSL invertebrates rather than the invertebrates themselves. Therefore, we explored the acute and chronic effects of selenium on the brine shrimp Artemia franciscana from the GSL. Larval Artemia, hatched from commercially harvested cysts, were exposed to selenium concentrations ranging from 0 to 10^(-4) g/L for 24 hours, in order to determine the doses inducing 100% and 50% (LC50) mortality. Larvae were then raised to maturity in non-lethal selenium concentrations, during which we estimated survival and maturation rate, and measured female fertility by counting the number of offspring (cysts or larvae), noting the presence of abnormal larvae or aborted eggs. Physiological stress was assessed by examining the amount of heat shock proteins using western blotting. In the 24-h exposure, mortality was 100% for concentrations equal to or greater than 10^(-3) g/L. The 24-h LC50 was 5 x 10^(-3) g Se/L. The 24-h mortality was not significant at levels measured in the GSL. In the chronic exposure, maturation rate did not differ between treatments. There did not appear to be a significant difference in fertility when shrimp were raised in 10^(-5) g Se/L, as there was no difference in brood size or presence of abnormal larvae and aborted eggs. However, the 10^(-4) g Se/L treatment was lethal to all shrimp before reproduction was completed. Heat shock protein Hsp70 seemed to be upregulated by higher selenium concentrations.

# Domestic Violence in Mass Media: An Analysis of Messages, Images, & Meanings in Motion Pictures

Renee Delcambre (Utah State University)
*Faculty Mentor: Jennifer Peeples*

The overarching goal of this research was to discover the framing strategies employed within depictions of domestic abuse and/or violence through mass media outlets and what potential impact that can have on the audience, particularly in assigning meaning to the topic. Specifically, this research analyzes the choices made in how domestic abuse/violence is framed within four popular motion pictures and the subsequent messages and meanings communicated. The research method used in this analysis is derived from rhetorical criticism which examines communication symbols within an artifact (subject) to reveal insights that ideally will aide in improving human communication (Foss, 2009). The specific rhetorical criticism method employed for this paper is generative which allows the researcher to generate units of analysis based on what is most interesting and/or unique about the artifact(s) (Foss, 2009). This qualitative analysis focused on two primary concepts. First, to determine the construction of fictional victims, fictional abusers, and the depicted abuse and establish the framing boundaries within the images and narratives. Second, the research reveals the framing strategies instituted by the producers of the films with the emphasis being on what makes them similar to each other and what, if anything, sets them apart. Findings reveal common depictions of fictional victims being young, beautiful, naïve, and fully responsible for ending the abuse. In contrast, fictional abusers are depicted as young, handsome, wealthy and/or in a position of authority, with each being provided a pathological reason for their behavior. Finally, the depicted abuse followed a similar path of predictable behavior from psychological manipulation and abuse to physical harm. This analysis also includes an in-depth literature review that exposes how this sensitive social problem is framed within newspapers, magazines, television, and motion picture films. The data was synthesized to reveal three predominate and universal framing themes which are: (1) patriarchal hegemony, (2) individualizing the problem, and (3) assigning blame to women. Mass media chooses what topics deserve attention and how to present the information giving it a powerful position of influence within our culture (Ryan, Anastario, & DaCunha, 2006). As a result, media has the ability to impact an audience's construction of serious social topics and issues. That makes this type of analysis vital in revealing communication strategies used by film producers as they depict partner abuse and the unavoidable, subsequent effects it has on viewers; such as in the formation of cultural beliefs and attitudes (Flood, 2009). Finally, analyzing the communication of a serious, deviant practice like domestic abuse, depicted in popular films, can assist in directing needed attention to a major social issue and provide readers the opportunity to "see" and discuss what is normally hidden and left unspoken within most cultures. References Flood, M., & Pease, B. (2009). Factors influencing attitudes to violence against women. Trauma, Violence, & Abuse, 10(2), 125-142. DOI: 10.1177/1524828009334131. Foss, S. K. (2009). 4th Ed. Rhetorical Criticism: Exploration and Practice. Long Grove, IL: Waveland Press. Ryan, C., Anastario, M., & DaCunha, A. (2006). Changing coverage of domestic violence murders: A longitudinal experiment in participatory communication. Journal of Interpersonal Violence, 21(2), 209-228.

# A retrospective study of the pro-coagulants rFVIIa, 4-factor PCC, and a rFVIIa and 3-factor PCC cocktail in improving bleeding outcomes in the warfarin and non-warfarin patient

Emma DeLoughery (Westminster College); Brian Avery (Westminster College); Thomas DeLoughery (Oregon Health & Science University)
*Faculty Mentor: Brian Avery*

In cases of severe bleeding, the physician must rapidly and effectively halt bleeding without the risk of clotting complications. Despite widespread use, no study has directly compared the effectiveness of the pro-coagulants recombinant activated factor VII (rFVIIa), the rFVIIa and 3-factor prothrombin complex concentrate (PCC) cocktail, and 4-factor PCC on improving patient outcomes. This study examined the medical records of 299 patients both on and off the anticoagulant warfarin prior to admission who received these pro-coagulants and were admitted to an Oregon Health & Science University ICU or through the emergency department. Mortality, length of stay, change in international normalized ratio (INR), plasma use, and number of clotting complications were used to assess effectiveness. In warfarin patients, the cocktail group had the greatest decrease in INR as well as lowest overall INR, but experienced a high though non-significant number of clotting complications. The rFVIIa group used the most plasma among warfarin patients. Non-warfarin patients in the cocktail group had the shortest length of stay, but the rFVIIa group had the lowest mortality. It may be prudent to consider the use of rFVIIa in treating extreme bleeding in the non-warfarin patient, while 4-factor PCC may be best for the warfarin patient, as that group experienced lowered INR and decreased plasma use without the increase in clotting complications.

# The Influence of El Niño on marine mammal abundance and human habitation of coastal Baja California, Mexico: Evidence from Abrigo de los Escorpiones.

John Doyle (University of Utah)
*Faculty Mentor: Jack Broughton*

El Niño events can have a devastating impact on marine resources while at the same time cause an increase in terrestrial productivity. These changes in marine and terrestrial resource productivity may cause a temporary change in the settlement patterns of local human populations. These issues are examined using data from Abrigo de los Escorpiones, Baja California, a trans-Holocene anthropogenic and raptor created deposit. This research focuses on the faunal remains and lithic artifacts from units D3 and D4, which are 2m x 2m unit that extend to a depth of 830cm and 500cm, respectively. Large mammal specimen recovered from the site were compared against the University of Utah, California State University, Chico and San Diego Natural History Museum reference collections to identify any that were pinniped or sea otter in origin. The identified marine mammal specimen and lithic tools were assigned ages based on radiocarbon dating for 5cm or 10cm levels. These aged levels were then aligned with sediment cores from Laguna Pallcacocha, Ecuador to provide a geologically based record of El Niño events extending 12,000 BP. The Number of Identified Specimen (hereafter, NISP) of marine mammal elements were compared to the geological El Niño records and resulted in no correlation. The NISP of marine mammal elements to the NISP of lithic tools resulted in positive significant correlation which is indicative of an increased marine mammal mortality rate resulting in a greater frequency of human and raptor scavenging. A very significant negative correlation was found between the NISP of lithic tools and the geological El Niño frequency which is indicative of decreased human occupational intensity at Abrigo de los Escorpiones during periods of high El Niño frequency. The decrease in occupational frequency is likely due to the inhabitants moving to an inland site where the terrestrial bounty is greater during El Niño events.

# CAPITAL ACCOUNT LIBERALIZATION & INCOME INEQUALITY: 1980-2009

Jess Esplin (University of Utah)
*Faculty Mentor: Cihan Bilginsoy*

In this paper, I examine the relationship between income distribution and the capital market account from 1980 to 2009 across a sample of developed and semi-developed countries. A review of the literature suggests that capital account liberalization raises income inequality. Several factors alleged to contribute to this outcome include increased macroeconomic volatility and financial crises, weakened progressive tax policies and transfer payments, and limited competition in financial markets. The literature is incomplete, with a need for an empirical analysis to determine if there is causality. I address this gap by running a panel regression analysis, with financial openness as the independent variable and inequality as the dependent variable. I use two alternative measures of income inequality-the Gini index and Palma ratio. Control variables include level of development, GDP per capita, I analyze the liberalization of capital markets using Quinn's (1997) index for financial openness. Control variables include level of development and income per capita. The sample selection of 34 countries were chosen based on available data for deciles, the Gini index, and the Quinn index across three decades: 1980s, 1990s, and 2000s. I will use these data to test the empirical model and my hypothesis that liberalizing a country's capital market account results in higher income inequality. I expect the results of testing the empirical model to show that greater financial openness results in increased income inequality, which has important policy implications in determining domestic financial policy.

# Development of computational strategies for improved environmental simulations of water and energy balances, air quality, and building energy use

Jeppesen Feliciano (University of Utah); Arash Nemati Hayati (University of Utah); Eric Pardyjak (University of Utah)
*Faculty Mentor: Eric Pardyjak*

In the recent decade, there has been more focus on urban microclimate studies due to the concerns for inhabitants' health, water and energy resource consumption as well as air pollution. The GEnUSiS (Green Environmental Urban Simulations for Sustainability) project utilizes large-scale computational platforms including QUIC (Quick Urban Industrial Complex) Dispersion Modeling System and Uintah:MPMICE (Material Point Method for Implicit Compressible Eulerian) to study the impact of green infrastructure elements on water consumption, energy use, and air quality. In particular, the group investigates moisture, heat, and pollutant dispersion in cities to provide useful information for urban planners on the design of sustainable cities. Modeling at higher grid resolutions (≤ 1 m) is more time-consuming and computationally-expensive. Moreover, previous low-resolution studies (i.e. 2 and 4 m) indicate significant modeling issues including grid misalignment, complex geometry sketch, and inflow wind directionality. To address the defects, a series of four MATLAB modules were developed. First, the conversion module imported building sketch data from previous versions of QUIC and converted it into a uniform matrix. Second, the geometry retention module passed the data through a filter, which removed or modified buildings based on dimensional retention criteria. This is mainly due to the grid resolution issues within Uintah:MPMICE code structure. Third, the pixilation module decomposed and replaced the non-rectangular buildings with a finite number of rectangular geometries while conserving the total volume. Fourth, the wind direction module rotated the computational domain according to the prevailing wind direction. The modified data was then exported to Uintah:MPMICE. The building loss percentage and plan area fractions for the test cases with 1, 2 and 4 m grid resolutions were compared against the original sketch data. This technical modeling progress has improved the validation of Large-Eddy Simulation (LES) numerical studies of momentum transport in the business district of Oklahoma City. Preliminary results indicate the accuracy of quicker, less computationally expensive models; the capability of modeling at lower resolutions including 2 and 4 m reduces the computational cost by the factors of 8 and 64, respectively. Furthermore, the rotation module has both reduced the size of the numerical domain and facilitated the inclusion of different prevailing wind flow directions. Finally, initial pixilation results indicate the possibility of modeling more sophisticated building geometries in Uintah:MPMICE. Future efforts include improving the accuracy of pixilation and creating a program to directly convert raw building data files from GIS (Geographic Information System) format into usable data structures for different simulation tools including QUIC and Uintah:MPMICE while integrating the techniques developed from this research.

# The Relationship Between Preschoolers' Engagement in Book Reading and Executive Functioning Skills

Aalia Fields (University of Utah)
*Faculty Mentor: Dr. Seunghee Claire Son*

Engagement in literacy-related tasks strongly predicts development of literacy skills and achievement for elementary age children (Guthrie & Wigfield, 2004). Engagement in learning tasks is a multidimensional concept, encompassing behavioral components such as involvement in activities and following directions; cognitive components such as self-regulation of attention and commitment to the learning process; and emotional components such as affective reactions to teachers, peers, and activities (Fredericks, Blumenfeld, & Paris, 2004). However, the complex dimensions of engagement in book reading, one of the most important tasks for literacy development, have not been examined with young children, and it is not clear what predicts reading engagement. Emerging literature explicates that executive functioning skills-defined as self-regulation of attention, working memory, and inhibitory control-are a strong predictor of classroom behaviors. These skills influence student ability to follow directions, attend to instruction, and engage in and complete tasks (McClelland et al., 2007), and thus, may predict reading engagement. The current research study explicitly examinse bookreading engagement to address: (1) how preschoolers' reading engagement develops over a school year; and (2) whether reading engagement is related to executive functioning skills. Participants of the study were low-income preschoolers' (N=175, aged 3-5) from three Head Start sites in urban areas of Mountain West Regions. Preschoolers' skills were assessed during the fall and spring of the school year. A teacher survey of Child Reading Engagement Rating Scale (Son, 2014) evaluated children's engagement during story time in classroom (i.e., attention, behavioral regulation and participation), and researchers assessed executive functioning of children's behavioral regulation using Head-Toes-Knee-Shoulders (Ponitz et al., 2008). Results showed that reading engagement does change over time. Comparison of the fall and spring measures of bookreading engagement showed that on average children's reading engagement improved over the school year ($t = 11.407$, $p < .001$). Detailed analysis of score changes demonstrated that while most children did not change their reading engagement substantially (68.1%), some children improved (i.e., increased more than mean +1 SD; 17.2%), and others decreased substantially (i.e., decreased more than mean - 1 SD; 14.7%). Results also suggest reading engagement is associated with executive functioning skills. Correlation analysis showed that fall executive functioning scores were associated with fall reading engagement scores ($r = .442$, $p < .001$), and spring executive functioning scores were associated with spring reading engagement scores ($r = .475$, $p < .001$). Regression analysis demonstrated that the development of executive functioning skills over a school year did not predict changes in engagement in book reading over time, but increased reading engagement over time significantly predicted development of executive functioning skills. Ultimately, results indicate that engagement in book reading influences changes in executive functioning rather than vice versa.

# Energy Recovergy from Pressure Retarded Osmosis

John Fisher (University of Utah)
*Faculty Mentor: Amanda Smith*

In Pressure Retarded Osmosis (PRO), mechanical work is extracted from the salinity gradient between fresh and salt water. This energy is recovered from a high pressure brine stream which is harnessed as it leaves the salt water. The purpose of this research is to demonstrate energy recovery from PRO using a downsized, 3D printed, Pelton turbine. The potential for power generation from PRO is particularly important here in the Salt Lake Valley. The Great Salt Lake is up to 8 times more salty than the ocean and the potential energy to be recovered is greater when the salinity gradient is larger. In published research, there has been no demonstration of energy recovery from the PRO process, only an approximation of the energy potential based off of the water flux across the osmosis membrane. The Pelton turbine in our benchtop model is fed by the brine discharge and turns a generator. The power output is measured using a multimeter to help record the changing power output as the brine pressure is varied. This is a new way to measure the power recovered through PRO. The project opens the door for the first quantitative analysis of a research demonstration with energy recovery built in, an essential step for developing PRO for power here in the Salt Lake Valley and elsewhere.

# Russia's Imitation Act through Don Quixote

Madeline Fowers Baum (Utah Valley University)
*Faculty Mentor: Angie Banchero-Kelleher*

Current research in dance history holds that dance, as a cultural artifact, reflects the culture. Noted dance anthropologist, Joann Kealiinohomoku stated "all dance forms reflect the cultural traditions in which they developed" (Kealiinohomoku 33). Through an analysis of dance important cultural values are revealed; dance is a reflection of a culture's history and indicates a culture's aspirations, political structure, and social expectations. Therefore, critically analyzing the ballet Don Quixote should provide insight into Russian culture in the late 1800's. However, further inspection of the ballet reveals several seeming contradictions challenging Kealiinohomoku's assertion. Don Quixote was a Spanish novel that first premiered as a ballet in Moscow's Bolshoi Theatre in 1869. It's interesting that a Spanish story premiered as a ballet in Russia. How does a Spanish story reflect Russian culture? To address this question the use of the frame of analysis New Historicism will prove to be very enlightening. New Historicism is a critical theory that interprets history as a cultural artifact; a way to learn how time and a place are linked together and reflect a specific culture (Tyson 286). Understanding the cultural atmosphere of 19th century Russia is essential to understanding why Russian ballet displayed elements from other countries. Russia, in the 19th century, went to great lengths to emulate European culture. The motivation behind this began in the late 1600's when the tsar, Peter the Great, attempted to close the perceived cultural gap between Moscow and Western Europe. To do so he established a 'Westernizing project' "to radically re-create Russian society in a European image--to make Russians into Europeans" (Homans 246). Peter aspired to be considered the "Russian Louis XIV" and for Russia to appear as powerful, cultured, and sophisticated as France, the leading world power of the time (Homans 246). As Russia emulated European powers, particularly France, cultural relics from those countries leaked into Russian ballet. Don Quixote, is a perfect example of Russian efforts to adopt Western cultural values in ballet. A review of written source material and a critical analysis of Don Quixote will demonstrate how Peter the Great's Westernizing efforts were noticeable centuries later as Western cultural values were still emulated through ballet to make Russia appear powerful, and therefore cultured.

# Availability of Information on Federal Aid and a Student's Enrollment

Jonathan Frehner (Southern Utah University)
*Faculty Mentor: Joshua Price*

Students often overestimate the cost of college, sometimes by 300%. Low-income students may assume that they can't attend college because they do not have the resources necessary to obtain a college degree. Because of their status they don't even apply for college, even though they have the grades and capacity to succeed. Our project looks at the relationship between a student's enrollment at Southern Utah University based on the information they were given about their eligibility for federal aid (Pell Grant). As Pell grants are based on family income, students who receive free or reduced price lunch are very likely to qualify for Pell grants. We have asked high schools in the state of Utah to send us lists of seniors that are on free or reduced price lunch, who also have a 3.1 GPA or higher. This enables us to offer their students who fall under this category automatic admission to the university, as long as they take the ACT/SAT. After we collect the lists of students from the schools, we then send out one of two letters to the students. One letter offers the student automatic admission to SUU, based on them completing the application, this is our control group. The second letter gives the same information, but in addition, states the actual cost of attending SUU based on them receiving federal aid and gives them instructions on how to fill out the FAFSA. Our hypothesis is that the students who receive the real cost of attending SUU and information about FAFSA will more likely apply and enroll in the university. This project aims at bridging the gap between low-income students and universities, giving them the chance to earn a college degree.

# Immune Response to Native American Antidiarrheals

Joe Fuell (University of Utah); Benjamin Tasevac (University of Utah); Randon Gruninger (University of Utah); Michael S. Bennett (University of Utah); Daniel T. Leung (University of Utah)
*Faculty Mentor: Daniel Leung*

Immune Response to Native American Antidiarrheals Joe Fuell, Benjamin Tasevac, Randon Gruninger, Michael S. Bennett, Daniel T. Leung Division of Infectious Diseases, Department of Medicine, University of Utah School of Medicine, Salt Lake City, UT Division of Microbiology and Immunology, Department of Pathology, University of Utah School of Medicine, Salt Lake City, UT Introduction Diarrheal diseases are one of the leading causes of death among children worldwide. Currently the rapeutics for diarrhea mostly target intestinal pathogens and their effectiveness has been increasingly compromised by the development of antimicrobial resistance. For years, the technological contributions of Native American cultures have been overshadowed by Western advances, especially in medicine. Many medical and herbal medicines from these cultures have been noted in historical records, including some which were used to treat diarrheal disease. Although some of these plants have been studied for antimicrobial properties, they have not been tested for their effects the host response to diarrhea. The objective of this study was to identify plants used historically by Native Americans along the Wasatch front, and observe their activation effects on immune cell. Methods We performed searches to identify plants used for diarrhea in the Utah American Indian Digital Archive, the Doris Duke Indian Oral History Collection and A History of Utah's American Indians, by Forrest S. Cuch. We chose four plants, Grindelia Squarosa (Gum Weed), Rosa Woodsii (Woods Rose), Rumex Crispus (Curly Dock), and Quercus Alba (Oak Leaf), based on their previously reported use by Native Americans for treatment of diarrhea. In order to test the plant compounds on human cells, the plants were frozen, lyophilized, and compounds extracted using methanol. Based on results from viability and dose range testing on a macrophage cell line (THP-1), 20, 80, and 320 fold dilutions were chosen for further testing. Supernatant from THP-1 cells exposed to varying concentrations of plant compounds were tested by IFN-γ ELISA. In addition, peripheral blood mononuclear cells (PBMC) exposed to varying compound concentrations were analyzed by flow cytometry using a panel that looked at viability and cellular activation by CD69, CD38, IFN-γ, and TNF-α expression in T cells (CD3+ CD19-), B cells (CD3- CD19+), and monocytes (CD3- CD19- CD14+). Results Supernatant from THP-1 cells exposed to varying concentrations of plant compound failed to show any IFN-γ by ELISA. However, among PBMCs, monocytes, but not T or B cells, showed marked upregulation of TNF-α in response to all four plant compounds, the highest expression being seen in response to Grindelia Squarosa (Gum Weed) extract (Figure 1). The effect was dependent on concentration. No TNF-α expression at any dilution was seen in a methanol-only control. Conclusion All four plant compounds had significant effects on monocyte activation, as seen by induction of TNF-α. Monocytes, which include dendritic cells and macrophages, play a critical role in antigen presentation to cells of the immune system and activation of innate immunity. Their activation by these plant compounds could potentially serve to alert other branches of the immune system, and enhance their responsiveness to pathogens which cause diarrheal disease.

# Standing postural sway and balance confidence in persons with Multiple Sclerosis at fall-risk as compared to controls

Austin Gamblin (University of Utah); Hina Garg (University of Utah); Leland E Dibble (University of Utah); Eduard Gappmaier (University of Utah)
*Faculty Mentor: Eduard Gappmaier*

Standing postural sway and balance confidence in persons with Multiple Sclerosis at fall-risk as compared to controls Gamblin, Austin; Garg, Hina; Dibble, Leland E.; Gappmaier, Eduard University of Utah, Salt Lake City, Utah Imbalance and falls are common symptoms in persons with Multiple Sclerosis (MS). Force platforms have frequently been used to assess postural stability, but detailed characteristics of standing postural sway are not well-documented for persons with mild-to-moderate MS. In addition, the relationship between objective postural sway measures and subjective report of balance confidence is unknown. PURPOSE. This study aimed to investigate the differences in standing postural sway parameters and subjective balance confidence in persons with MS as compared to age-matched controls. The relationships between postural sway parameters and balance confidence were also examined. METHODS. Nineteen ambulatory persons with MS at fall-risk (mean + or - SD: age=53.4 + or - 11.7 years, EDSS=4.9 + or - 1.0, Disease Duration=16.0 + or - 11.4 years) and 14 age-matched Healthy Controls (HC) (age=54.6 + or - 11.9 years) were recruited. Participants were asked to stand still for 25 seconds with their eyes open on an in-ground force platform for 10 trials and center of pressure was recorded. Postural sway parameters included sway velocity, sway frequency, Medio-Lateral (ML) and Anterior-Posterior (AP) sway amplitude and total sway path. Balance confidence was assessed by the self-reported Activities-specific Balance Confidence (ABC) Scale. Between-group differences by Mann-Whitney U tests and spearman rank correlations were determined. RESULTS. As opposed to HC, persons with MS demonstrated significantly ($p<0.01$) increased sway velocity, sway frequency, ML and AP sway amplitude, total sway path and decreased ABC scores. Moderate-to-strong negative correlations were observed between all postural sway parameters and ABC scores. CONCLUSIONS. Persons with MS demonstrated widespread impairments in standing postural sway and balance confidence suggesting poor postural control during a quiet standing task as well as activities of daily living. The objective postural sway parameters were correlated with subjective balance confidence as well. These findings suggest the utility of laboratory and self-report postural stability measures in individuals with mild-to-moderate MS at known fall-risk for balance assessments. Future research should examine the effect of therapeutic interventions on postural stability measures in persons with MS.

# Tactile Stimulation Device for Training Human Amputees to Recognize Activation of Different Sensory Afferents during Utah Slanted Electrode Array Stimulation

Kacey Gao (University of Utah); David Page (University of Utah); Gregory Clark
*Faculty Mentor: Gregory Clark*

Tactile Stimulation Device for Training Human Amputees to Recognize Activation of Different Sensory Afferents during Utah Slanted Electrode Array Stimulation Kacey Gao, David M. Page, Gregory A. Clark Abstract There is a need for better prosthetic devices in the market that can provide sensory feedback. In recent studies, the Utah Slanted Electrode Array (USEA) has been implanted into the peripheral arm nerves of amputees to electrically stimulate remaining axons of sensory receptors. Although it is extraordinary to provide sensations of a nonexistent hand, it is difficult to interpret subjective descriptions of these sensations to help determine which sensory receptor subtypes are activated by each electrode of the USEA. A common vocabulary of sensation descriptions, and a method to train subjects to assign this vocabulary to appropriate sensations, is needed. This research focuses on creating a tactile stimulation device that can mechanically activate the skin and evoke the sensory percepts expected for USEA stimulation of 3 major cutaneous mechanoreceptor subtypes: Slowly Adapting type 1 Receptors (SA1), Rapidly Adapting type 1 Receptors (RA1), and Pacinian Corpuscles (PC). Specifically, the expected perceptual responses of SA1s, RA1s, and PCs in response to USEA stimulation are evoked for 3 conditions of tactile stimulation: constant pressure, ~10-25 Hz vibration, and ~25-200 Hz vibration. We designed, built, and tested a device which: a) outputs sinusoidal mechanical vibrations of 0-250 Hz, b) has multiple probe sizes for stimulating various areas of skin, and c) operates as both a handheld instrument and as an attachable component of a stereotaxic manipulator. This tactile stimulation device is important for creating a common, agreedupon vocabulary between the subject and investigator for each sensation. One human subject underwent tactile stimulation training prior to implantation of two USEAs in his residual peripheral arm nerves. During subsequent experiments, the subject classified percepts evoked by stimulation of different electrodes of the 100-channel USEAs. In addition to proprioceptive percepts, the subject identified 21 percepts as having a quality of constant pressure, 6 USEA-evoked percepts as having a quality of tapping/flutter, and 8 percepts as having a quality of vibration/buzzing, likely corresponding to activation of SA1, RA1, and PC afferents, respectively. By understanding the descriptions of sensations given by the subject through both mechanical and electrical stimulation, the investigator may also obtain insight on what type of axon is activated during USEA microstimulation. Keywords: Utah Slanted Electrode Array, sensory receptors, tactile stimulation

# MEPP II (Mobile Elemental Power Plant II) Research Project

John Garrett (Weber State University); Brad Richey (Weber State University)
*Faculty Mentor: Julie McCulley*

Mobile Elemental Power Plant II (M.E.P.P. II) Research Project In the past 60 years, renewable energy such as wind, micro-hydro, biomass, and solar energy have grown exponential in size and value. The most used of all these renewable energies is solar energy. Solar energy has been used in various ways to obtain the energy from the sun and convert it into electrical power for residential and commercial use. It is free, abundant, and cleaner to use rather than traditional methods of using coal and petroleum (oil). In the year 2011, students and faculty in the Engineering Technology Department at Weber State University developed and fabricated the Mobile Elemental Power Plant or MEPP. MEPP is a "selfsustaining system that was designed with predetermined specifications that would replace a typical transportable gas-powered generator". MEPP was built with the idea to help with the country's ongoing energy crisis by using renewable energy, such as wind and solar energy. In addition, MEPP was built to help with emergency situations, natural disasters, military operations, and remote medical sites where traditional power supplies are limited. Students at Weber State University are able to test and monitor with MEPP to gain the knowledge they need for future projects within their field of study. The Mobile Elemental Power Plant II or MEPP II is an on-going research project to analyze the generation and consumption of electrical power through portable power plants on a daily basis. This research project will show how accessible electrical power can be used and to determine the maximum power MEPP II can provide during the different seasons of the year. Other results of this project will be tested and analyzed on how much electrical power can be generated during conditions of optimal and nonoptimal weather. Weather conditions include rain, snow, ice, shade, sunlight, and temperature variations. Our testing and analyzing will show the performance of MEPP II on how functional it can be during these weather conditions. In conjunction with this project, we have designed and developed a Solar PV array mounting system to provide flexibility in the MEPP II portability and to be more user-friendly. The mounting system will enable for a quick and precise set-up to gather solar energy. A full analysis will be performed with our data and will be compared with that of nonrenewable energy sources for purposes of showing that renewable energy can be very effective for generating and storing energy. This will help provide possibilities of using electrical power for personal, economical, commercial, and natural disaster relief use. To continue this research, a solar tracking system will be designed and developed in the near future to provide more flexibility in the MEPP II portability. Other projects will be designed and developed to further investigate how much solar energy can be generated and consumed more efficiently for daily usage. Furthermore, students and the community will be educated to a real-world perspective on renewable and sustainable energy.

# The Untold Story of how one State chose to Move Away from Sex Offender Residency Restrictions

Shanice Gipson (Weber State University)
*Faculty Mentor: Monica Williams*

When it comes to sex offenders most states have established residency restrictions even though there is a lack of information to support their effectiveness. Eighteen states currently do not have residency restrictions with Kansas being the only state to have passed a law prohibiting cities or counties from adopting residency restrictions. K.S.A 22-4913 was passed in 2013 as a way to prevent any city within the state from enforcing residency restrictions. This study looks at archival government documents and analyzes why Kansas passed this law. By looking at committee meetings and other government notes the story of what transpired in the Kansas legislature before the passing and finalizing of the law in 2013 can be found. The preliminary findings show that Kansas legislators were influenced by a study that was conducted in Iowa and later by the Kansas Sex Offender Policy Board showing that residency restrictions are ineffective.

# International Nursing Student Collaboration: Finland and U.S.

Kailey Goodman (Brigham Young University)
*Faculty Mentor: Leslie Miles*

Title: International Nursing Student Collaboration: Finland and U.S. Authors: Kailey Goodman SN and Leslie Miles DNP, APRN Purpose: The purpose of this research was to evaluate the effectiveness of international nursing student collaboration activities between Brigham Young University (BYU) and Finnish (MAMK) nursing students in increasing self-confidence, communication skills, and understanding healthcare systems. Research Question/ Hypothesis: 1) Describe the effectiveness of international collaboration experiences for BYU and Finnish students. 2) Were the ancillary activities (Skype and e-mail) effective in increasing collaboration and communication? 3) Was the preparatory contact effective at enhancing the international collaboration experience? Methodology: • Setting: BYU, Provo, Utah and Mikkeli University of Applied Sciences (MAMK), Savonlinna, Finland. • Sample: 10 BYU and 30 Finnish nursing students • Ten Students from BYU were paired with 2-3 students from MAMK for e-mail and Skype encounters prior to one day of planned activities in Finland. • Instruments: 15-item pen and paper questionnaire • Procedures: IRB and Finnish nursing school approval obtained. All participating students completed consent prior to survey administration. • Data Analysis: Responses entered into Qualtrics for descriptive quantitative analysis. Qualitative data was analyzed for themes. Findings: Findings indicated that students believed that working with a foreign peer increased their confidence and communication skills. While BYU students felt their understanding of healthcare systems increased; MAMK did not feel as robust in understanding health care issues in another culture. Implications for Nursing: • Intercultural learning experiences allowed students from both schools to grow in the areas of understanding other cultures and nursing practices, communication, and self-confidence. • Facilitating interactions between nursing students from different cultures, allows students to be better prepared to serve and care for patients from differing cultures. Conclusion: Although there were only a few structured interactions, the first year data indicates that this type of international collaborative learning is beneficial for nursing students to increase their cultural competency, communication skills, self-confidence, and understanding of healthcare systems.

# How Well Can Machine-learning Algorithms Predict Biomedical Outcomes Based on Gene-expression Data

Anna Guyer (Brigham Young University); Stephen Piccolo (Brigham Young University)
*Faculty Mentor: Stephen Piccolo*

Biomedical data are increasing in size and complexity. For example, it is possible to profile expression levels for thousands of genes in one experiment. Such gene-expression information can be used as a biomarker to predict specific biomedical outcomes. These outcomes might include development of a disease, survivability, reaction to a drug, or other such medically relevant information. To make sense of such a large number of data points, biomedical researchers often use "machine-learning" algorithms, which are developed by the computer-science community to account for complex interactions among a large number of variables. Hundreds of "machine learning" algorithms have been developed, but no consensus has been reached on which algorithm(s) are best for gene-expression data. Many researchers simply use the algorithms that they are most familiar with, thus potentially missing out on higher accuracy that may come from using other algorithms. Due to the medical nature of biomarker predictions, having the utmost accuracy is critical. Data-sharing policies have been implemented by academic journals and research-funding agencies; this means that there are thousands of gene-expression data publicly available. We are carefully compiling and curating 100 such data sets and are performing a systematic benchmark comparison across many machine-learning algorithms. As an important preliminary step, we are documenting various attributes of each dataset, for example the biomedical outcome that is being predicted, the clinical variables recorded for each patient, and the gene-expression platform that was used for profiling. In addition, we are converting the data into "tidy data" format so that it will be easier for other researchers to apply and to extend our benchmark analyses. We will make these data available as a community resource. A somewhat similar compilation of smaller data sets-not related to gene expression- was generated many years ago and is still in wide use today; we hope that our compilation will have a similar impact on the biomedical and machine-learning communities. Our current analysis includes a performance comparison across 24 "machine learning" algorithms and a statistical analysis of the results to compare accuracy rates across the algorithms. Our preliminary results suggest that "ensemble" methods-which combine evidence across multiple algorithms- result in the best performance overall. The Support Vector Machines and Random Forest classification algorithms also performed quite well when executed independently.

# Making CSI Dreams a Reality: Microfluidic DNA and Small Molecule Analysis

Allison Hadley (Southern Utah University); Mandy Nelson (Southern Utah University)
*Faculty Mentor: Christopher Monson*

Making CSI Dreams a Reality: Microfluidic DNA and Small Molecule Analysis We are developing a microfluidic device that will take a small sample of material, separate DNA, proteins, vitamins, and metabolites from each other and analyze the separated compounds. DNA, protein, and small molecule identification and quantitation are important in many disciplines including biochemistry, biology, medicine, and forensics. Current DNA and small molecule analysis requires the use of lab equipment found in specialized laboratories. This equipment is expensive, difficult to operate, relatively slow, and only operable in sterile lab environments. If successful, our device would be able to separate and at least partially analyze the proteomic, genomic, and metabolomic characteristics of a sample quickly and cheaply outside of the lab. The device is made by creating a channel in layers of PDMS. The channel is lined with electrodes to create an electric field, in which a sample containing charged molecules can be separated through electrophoretic field flow fractionation. A microfluidic device is well suited for this type of analysis due the low cost associated with making one and the ability of the device to be modified to the user's needs. Our device could have a significant impact on many fields depending on the detection and quantitation of biological molecules. We are currently in the initial stages of device development: optimizing sample introduction and initial separation.

# Insights into Human Diseases with Plant Mitochondria

Collin Hansen (Brigham Young University)
*Faculty Mentor: Brent Nielsen*

Petite integration frequency 1 (PIF1) is an important helicase protein conserved from bacteria to humans. While the specific function of the PIF1 protein has been studied heavily in several organisms, (bacteria, yeast, humans), it has yet to be studied in plants -its localization and function remain unknown. Problems with mtDNA helicase proteins have been linked to several human diseases; Alzheimer's, premature aging and even cancer can all trace many of their roots to these crucial organelles. Because of high levels of homology in the mitochondria, manipulation of these organelles and associated proteins in plants can help elucidate functions in humans and aid in the development of treatments for mitochondrial related diseases. In preliminary research, a homolog to human PIF1 was identified in the plant species Arabidopsis thaliana. Seeds deficient in the protein were obtained and showed a clear phenotype when compared to the wild-type. Our ongoing project aims to determine the localization and function of PIF1 within the plant cell by utilizing confocal microscopy, quantitative reverse transcriptase PCR (qRT-PCR) and reintroduction of the PIF1 protein into the mutant plants. This will allow us to better understand the role of the protein in mtDNA processing and increase the effectiveness of plants as model organisms for studying mitochondrial related diseases in humans.

# Kinetic Characterization of Proliferation and Dedifferentiation of Müller Cells

Joshua Hansen (Brigham Young University); Collin Sanderson (Brigham Young University)
*Faculty Mentor: Alonzo Cook*

Approximately 11 million Americans suffer from dry age-related macular degeneration (dry AMD), an eye disease that occurs in the macula of the eye when retinal pigment epithelial (RPE) cells experience oxidative stress and die. In several species (including rats, zebra fish, and chicks), photoreceptor regeneration is possible with the appropriate stimulus. Müller cells have been shown to be the critical cell in photoreceptor regeneration. In zebra fish and chicks, Müller cells dedifferentiate to a proliferating progenitor cell when photoreceptors are damaged. These progenitor cells are then transported to their final area in retinal tissue where they differentiate to photoreceptors and integrate into the retinal tissue. Activation of cellular signaling pathways (Notch, MAPK, and others) is integral to this process. On each level of regeneration (dedifferentiation, proliferation, differentiation, migration and integration), these signaling pathways guide cell behavior, producing new photoreceptors that replace dead or damaged photoreceptors. A therapy guided by this knowledge could replace more intrusive methods to potentially cure dry AMD. Dedifferentiation and differentiation of Müller cells is a potential option for curing dry AMD. The therapy would involve inducing Müller cells to transform into the needed photoreceptors. This would likely involve initially dedifferentiating the Müller cell into a progenitor state and then inducing the progenitor cells to become photoreceptors. The dedifferentiation step has been qualitatively observed in vitro. Determination of the proliferation kinetics was performed in-house by isolating Müller cells and obtaining time-resolved cell counts. A Wistar albino rat eye was dissected and the retina was removed, dissociated and cultured. The Müller cells were isolated and divided into several different 25 mL flasks. An initial cell concentration was measured with a microfluidic cell counter. Cell counts were taken at regular time intervals. Assuming a 1st order model of proliferation dependent on cell concentration, the rate constant was found to be 0.09/hr for cells cultured with fetal bovine serum. This rate constant dropped to 0.03/hr when fetal bovine serum was removed from the growth media. This value matches data reported by Limb1 and is similar to data reported by Zhao2. The shape of the cells was observed to shift to a dendritic neuronal shape. The concentration of proteins typical of photoreceptor progenitor cells was assumed to be proportional to the number of cells, and the rate constant for dedifferentiation was determined to be 0.35/hr. When combined with proliferation kinetic data, it is clear that dedifferentiation occurs much faster than proliferation. This project will continue by attempting to determine the rate constants for differentiation into photoreceptors, and will be confirmed through immunocytochemistry. Also the model will be modified to handle non-first order rates. Eventually, once the system is defined, the model will allow the optimal design of therapies for retinal degeneration. References 1. Limb, Astrid; et al. Differences between the neurogenic and proliferative abilities of Müller Glia with stem cell characteristics and the ciliary epithelium from the adult human eye. Exp Eye Res. 93(6): 852-61. Dec 2011. 2. Zhao. Induction of Retinal Progenitors and Neurons from Mammalian Müller Glia under Defined Conditions. J. Bio. Chem. Feb 2014.

# Supported Lipid Bilayer Stripping

Whitney Hansen (Southern Utah University); Mason Valentine ; Cameron Cooper
*Faculty Mentor: Chris Monson*

Lipid membranes are a necessary component of living things. In addition to keeping the contents of a cell separate from the environment, they play a major role in intracellular signaling, drug action, nutrient absorption, and metabolic pathways. A problem facing scientists researching biological lipid membranes is that some of the components are sensitive to changes in conditions and can lose their functionality when purified. One proposed method around this problem is to separate the components in a supported lipid bilayer, an environment that is very similar to a cell membrane, before carrying out analyses. This presentation is focused on a method for repackaging supported lipid bilayers into lipid vesicles, which may have an application for use with supported lipid bilayers after a separation has occurred. The method used is flowing buffer at a high rate over a supported lipid bilayer, causing stripping of the bilayer to occur.

# Interspecific Hybrids in Penstemon

Sarah Harrison (Brigham Young University); Bryson Ensign (Brigham Young University); Mikel Stevens (Brigham Young University)
*Faculty Mentor: Mikel Stevens*

In plants, interspecific hybrids, also known as wide crosses, are produced from a cross between two related species that normally do not reproduce naturally with each other. However, through the use of breeding techniques, it is possible to make wide crosses and obtain plants with greater genetic diversity with unique genetic traits. Penstemon, with over 270 different species, is among the largest native genera in North America. Commercially acceptable cultivars of both selections of a specific species and interspecific crosses within Penstemon are found in both the North American and European markets; however, these cultivars are almost universally lacking in drought and extreme temperatures tolerance. These characteristic as well as colorful abundant flowers and foliage, in the native Penstemon of the US Intermountain West, are of great interest to the urban landscape markets of the desert areas of this region. For example, Utah has over 70 native species of this genus ranging from mat forming to taxon that grow to at least three feet tall and flowers that are red, blue, white, to florescent pink in different Penstemon species. Our research focuses on tapping into these desirable characteristics by using wide crossing, within Penstemon, to develop commercially viable cultivars that are drought tolerant and hardy for use in desert urban landscape environments. As we have worked with Penstemon, we have successfully made approximately 30 wide crosses involving 20 unique species which produced seed during the 2015 growing season. We are now determining the viability of these seed by trying to germinate them. Current research suggests that two of our 2014 wide cross hybrids predominantly exhibited the mother plant's phenotype. Ongoing analysis will uncover the reasons for this and its implications on breeding within this genus. For these reasons and others, this research provides valuable information that can be used by researchers and the horticultural breeding industry to produce plants with tolerance to drought and temperature extremes.

# Sense of Community: A comparative study of high school extracurricular activities

Erica Hawvermale (Utah State University)
*Faculty Mentor: Travis Dorsch*

Extant research has linked high psychological sense of community (PSOC) in adolescence to adaptive outcomes such as enhanced motivation, self-efficacy, and ability to cope with major life transitions (Baumeister & Leary, 2014; Compas et al., 2005; Henry & Slater 2007; Vieno et al., 2005). High PSOC is also associated with reduced stress, anxiety, and depression, as well as reduced likelihood of gang involvement (Battistch & Hom, 1997; Baumeister & Leary, 2014; Royal & Rossi, 1996). In light of these findings, the present study was designed to analyze the relationship between high school students' participation in extracurricular activities and their perceptions of PSOC. Participants (N = 701) were 276 males and 425 females (Mage = 16.51; SD = 1.16) who were actively engaged in competitive (e.g., sports; n = 218), performance (e.g., music; n = 370), and participatory (e.g., clubs; n = 113) activities in high school. Students responded to survey items assessing their enjoyment of and commitment to the activity, and their perceived sense of community. MANOVAs revealed significantly lower reports of enjoyment and motivation among students participating in performance groups than among students participating in competitive and participatory groups. Group difference tests also revealed higher perceptions of sense of community among students in competitive and participatory groups than students in performance groups. Follow-up qualitative focus groups with participants suggest that students in performance groups may experience lower enjoyment, commitment, and sense of community due to the compulsory nature of activities such as band, choir, and orchestra in high school. This research illuminates the potential benefits of autonomous participation in competitive and participatory activities in high school, and suggests that PSOC may be an underlying mechanism enhancing the potential for students to experience positive developmental outcomes from their participation.

# Implicit Racial Bias and Memory: The Effects of Racial Salience on Jurors Memory

Sarah Hendricks (Dixie State University)
*Faculty Mentor: John Pugliese*

Years of research on implicit racial biases demonstrate that unconscious attitudes affect decision making. These finding have serious implications when examining our legal system. African American men are imprisoned at six and half times the rate as Caucasian men. African American men also receive harsher sentences then their Caucasian counterparts for the same crime (Sabol, 2008). It is likely that implicit racial biases play a in role in these sentencing inequalities. Therefore, researchers have been investigating ways to suppress these implicit racial biases. One way to suppress implicit racial biases is to make race salient in court cases. Implicit racial biases may not only affect decision making but also memory. Recent research has shown that implicit racial biases may affect the type of information remembered by jurors. The purpose of the current study is to examine if making race salient in court cases affects jurors memory recall. Participants will be randomly assigned to racially salient or racially neutral defense arguments. The experimental group will receive defense arguments that highlight race while the control group defense arguments will have no mention of race. It is hypothesized that the experimental group will have a better memory recall, render less guilty verdicts and render less sever sentences. The results of this study will add to the current body of research examining implicit biases and memory as well as research on how to suppress implicit biases.

# The Study of the Interaction of FLIG and H-NS in Salmonella Typhimurium

Christine Henry (University of Utah); Kelly Hughes (University of Utah)
*Faculty Mentor: Kelly Hughes*

THE STUDY OF THE INTERACTION OF FLIG AND H-NS IN SALMONELLA TYPHIMURIUM Christine Henry, Major in Biomedical Engineering Kelly Hughes, Department of Biology The H-NS protein in Salmonella Typhimurium condenses DNA allowing 1mm of DNA to reside within a 1 x 2 micron cell body. H-NS also binds to a single protein in the cell: the flagellar motor protein FliG. The purpose of this interaction is not understood. This project focuses specifically on the interaction between FliG and H-NS. Trp substitutions at amino acid positions 126 and 160 of E. Coli FliG were found defective in binding H-NS. Using targeted mutagenesis, phage transductions and various motility and other phenotypic tests, mutations were made in positions 126 and 160 of Salmonella FliG. We hypothesized that the role of H-NS:FliG interaction was to bring the DNA encoding the flagellin filament gene (fliC) to the flagellar base for localized transcription to facilitate the flagellar assembly process. The goal was to determine if this DNA localization mechanism could be replaced by many copies of the fliC gene expressed from a plasmid vector. The fliC plasmid vector was placed into the FliG 126::Trp and FliG 160::Trp strains. Complementation of the H-NS binding defect by the fliC plasmid vector was tested using a plate motility assay for flagellar production and function. The fliC did not complement the FliG mutant alleles for motility and the cells exhibited no change (non-motile), or reduced motility. Immunofluorescence microscopy was also used to visualize flagellar assembly. Analysis of the microscopy images revealed that the mutants were assembling flagellar filaments. Thus, the tryptophan mutants were able to assemble filaments but had a defect in the rotation of their flagella. From these findings, it is not clear that H-NS is involved in the localization of flagellin filament at the flagellar base.

# Preferential Breakpoints in the Recovery of Broken Dicentric Chromosomes in Drosophila melanogaster

Hunter Hill (University of Utah); Kent Golic (University of Utah)
*Faculty Mentor: Kent Golic*

The most common inherited form of intellectual disability in humans is caused by a condition called Fragile X. One property of a Fragile X chromosome is a tendency to break at a specific site, which was called a fragile chromosome site. In certain cells, chromosomes of the fruit fly Drosophila melanogaster have a number of specific sites that are thin or constricted when compared to the rest of the chromosome. These narrowed regions in Drosophila chromosomes are called intercalary heterochromatin. About 30 years ago, Charles Laird proposed that intercalary heterochromatin sites were analogous to the fragile site of Fragile X. Since then, it has been shown that intercalary heterochromatin in Drosophila chromosomes, and fragile sites in human chromosomes, share the property that they replicate very late in the cell cycle. However, it was not known whether sites of intercalary heterochromatin in Drosophila chromosomes were also prone to breakage in cells undergoing normal division. We devised a scheme to break the Drosophila X chromosome and determine whether it would break randomly or at preferred sites. We found that the X chromosome has a strong tendency to break at a few preferred sites, and moreover, these sites match sites of intercalary heterochromatin. These results support Laird's hypothesis and suggest that Drosophila may be a useful model for understanding human chromosome fragile sites.

# Comparison and Contrast of The Navajo Diné Bahane' and Bible Creation Stories

Rakael Hinton (Southern Utah University)
*Faculty Mentor: Dr. Nozomi Irei*

Purpose: Creation stories exist around the world. The Diné Native American/Navajo culture has a unique perspective of the creation which many have paralleled with the Genesis creation narrative from the Bible. The Navajo culture continues to evolve, continually adapting to current events that impact the nation within a nation. Study of the creation story, also known as Diné Bahane' in the Navajo Language and which was given only in oral tradition from generation to generation, has been able to be examined in more detail. While there currently exists several interpretations of the creation story with the Bible, there is little research that evaluates the texts together as valuable literature comparisons. Research Methodology: This analysis of the first ten chapters of the Bible's Book of Genesis and the Navajo Diné Bahane'creation story is a literature comparison and contrast analysis in the definition of tragic or comic literature using the analysis methods of Frye's "Archetypes of Literature" and Levi-Strauss's "The Structural Study of Myth". The creation events of both texts arranged both diachronically and synchronically, according to the two analysis structures, present similarities and differences of the two versions of the creation stories, and are then analyzed for binary oppositions that the mythology may contain. Conclusion: The use of Frye's archetypical analysis of the Bible and the Diné Bahane' demonstrates that the Diné Bahane' is comic literature in general, even though the flood is identified as tragic. The Bible's Genesis, in contrast, begins as a comic with emphasis on the Garden of Eden and the state of innocence that existed there, but quickly fell into the tragic definition by presence of the serpent. Levi-Strauss's structuralism method shows at least two binary oppositions for both texts. Both methods detailed by Frye and Levi-Strauss can be applied to the constructs of literature, but each incorporates a different system of thinking that can be appreciated. While more analysis and evaluation of both texts is obviously needed, the Bible and the Diné Bahane' will continue to influence both individual perspective and cultural direction. Keywords: Bible, Genesis, Diné Bahane', creation story, myth, legend, oral tradition, literature comparison, Frye, Levi-Strauss, structuralism method, archetypes, Navajo, Four Worlds, comedy and tragedy

# Overexpression of HDAC1 induces functional β-cell mass

Amanda Hobson (Brigham Young University)
*Faculty Mentor: Jeffery Tessem*

β-cells sense elevation in circulating glucose levels and secrete insulin to maintain normoglycemia. Type 1 and Type 2 diabetes have different initial causes, but both forms ultimately result in decreased functional β-cell mass. Functional β-cell mass is defined as the rate of glucose stimulated insulin secretion multiplied by the total β-cell mass. The total β-cell mass is a function of cellular proliferation and death rates. β-cells have a very low proliferation rate, therefore determining the mechanisms that induce β-cell replication for pancreatic islet transplantation, or increasing the endogenous β-cell population could be used to cure diabetes. Nkx6.1 overexpression increases functional β-cell mass. We have shown that Nkx6.1 induces HDAC1. We have also shown that HDAC1 overexpression induces β-cell proliferation, maintains glucose stimulated insulin secretion and protects against apoptosis. HDACs function by removing acetyl groups from histones, which results in decreased expression of genes. HDACs have been shown to downregulate expression of cell cycle inhibitors. We hypothesized that HDAC1 mediated proliferation would correspond with decreased expression of cell cycle inhibitors (CDKI's). We measured expression of all known CDKI's, and were able to show that p15 mRNA was significantly decreased in response to HDAC1 overexpression. We present a model by which p15 expression influences the HDAC1 mediated β-cell proliferation pathway.

# Weight Management Differences Between Emerging Adults and Adults

Jackie Hobson (Utah Valley University); Christopher Anderson (Utah Valley University)
*Faculty Mentor: Christopher Anderson*

Abstract Obesity and poor weight management are critical public health issues. During the last 30 years obesity has continued to rise (Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006). Overweight individuals usually have increased body fat which elevates their risk for negative physical and mental health outcomes. Young adulthood is a developmental period that is characterized by rapid weight gain resulting in the greatest increase in individuals being overweight or obese (Gordon-Larsen, Adair, Nelson, & Popkin, 2004; Hebden, Chan, Louie, Rangan, & Allman-Farinelli, 2015). This phase in life (between the ages of 19-25) is often referred to as emerging adulthood. Emerging adulthood is distinctive from other developmental stages because it is full of important life transitions, including finding one's identity. Identity development can include healthy or unhealthy weight management skills which can transition into long-term behavior patterns (Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). Because weight gain is so significant during emerging adulthood it is important to understand their weight management habits. The current study investigates weight management skills, as well as perceptions, of emerging adults in comparison to older adults. This study consists of 270 participants, both emerging adults (n = 202, M = 21) and older adults (n = 68, M = 34). Each participant completed a brief weight management questionnaire, demographic and weight history survey, and were measured for BMI and body fat percentage to attain their current weight status. Questionnaires were analyzed for difference between the two groups. Our study found that weight management skills are similar between the two groups, with a few exceptions. Older adults tend to check their weight more frequently ($p = .010$), and emerging adults reported higher levels of physical activities ($p = .027$) and more willingness to modify their diets ($p = .005$). When comparing the two groups personal weight perceptions emerging adults on average are more comfortable with their weight ($p = .003$) and are more confident that they would be able to lose weight if they wanted to ($p = .022$). Although weight management skills are similar in the two groups there is a significant correlation with higher BMI's and increased age ($r = .228$). One possible explanation may be that emerging adults keep the same weight management habits as they get older and their metabolism slows down. It may be beneficial to teach emerging adults to develop positive weight management skills and educate them on the physical changes that effect their weight as they age. References Gordon-Larsen, P., Adair, L. S., Nelson, M. C., & Popkin, B. M. (2004). Five-year obesity incidence in the transition period between adolescence and adulthood: the national longitudinal study of adolescent health. The American Journal of Clinical Nutrition, 80, 569-575. Hebden, L., Chan, H. N., Louie, J. C., Rangan, A., & Allman-Farinelli, M. (2015). You are what you choose to eat: factors influencing young adults' food selection behavior. Journal of Human Nutrition & Dietetics, 28(4), 401-408. Doi:10.1111/jhm.12312 Nelson, M. C., Story, M., Larson, N. I., Neumark-Sztainer, D., & Lytle, L. A. (2008). Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. Obesity, 16, 2205-2211. Ogden, C. L., Carroll, M., Curtin, L., McDowell, M., Tabak, C., & Flegal, K. (2006). Prevalence of overweight and obesity in the United States, 1999-2004. JAMA: Journal of The American Medical Association, 295 (13), 1549-1555.

# Barriers to Health Care Access For Refugees in Cache County, Utah

Michael Hoggard (Utah State University); Joshua Blotter (Utah State University)
*Faculty Mentor: Julie Gast*

There are over 300 refugees resettled in Cache County, Utah. Despite coming from very different cultural and ethnic backgrounds, the Cache County refugee population shares a remarkably similar set of circumstances in regards to access to health care, and these similarities provide a unique potential for insight in this study. Some key factors that influence the refugees' ability to access health care are the ability to communicate, availability of information and social services, and access to health insurance. Even though all of these refugees should technically have access to health care through their work-provided health insurance or Medicaid, many of them do not use it and have repeatedly forgone necessary medical procedures. The purpose of this study is to examine key physical, structural, and cultural barriers that prevent refugees from accessing health care. Data collection includes a variety of guided, in-depth interviews from 3 different perspectives of barriers to health care: 1.) refugees (n=12), 2.) members of refugee resettlement and assistance agencies (n=2), and 3.) health care providers with particular experience providing services to refugees (n=2). The goal of this study is to make volunteer and social service agencies, health care providers, and state legislators more aware of some of the diverse barriers facing refugees as they attempt to access health care, and to help to provide necessary information to bridge some of these barriers in the future. This study is particularly relevant for refugees living throughout Utah, as well as many of these barriers are shared by refugee populations living throughout all of the United States as they face similar cultural, physical, and structural barriers, and as they navigate the same health care legislation.

# Chemopreventive efficacy of different chemical forms of Selinium individually and in combination in LNCaP prostate cancer cells.

Cortney Holmes (Brigham Young University); Taalin Rasmussen (Brigham Young University); Angelo Garcia (Brigham Young University)
*Faculty Mentor: Merril Christensen*

Combination therapy has long been a staple in the fabrication of various products but in traditional medicine it has not been included in a systematic way when examining dietary components and approved chemotherapeutic agents. In our study, we analyze the effects of compounds known to have chemopreventive properties specifically selenomethionine and sodium selenite, and how combining these compounds inhibit growth of early stage prostate cancer. The rationale behind our approach is to provide treatments that provide a multi-mechanistic method of treatment by targeting different pathways, slowing or halting the progression of cancer more than any single compound can do alone. Using reliable and accepted statistical techniques, this study blends chemopreventive agents in order to create the most potent mixture. Our preliminary experiments using response surface methodology have shown that simple two-component mixtures significantly improve the cytotoxicity of chemopreventive agents.

# Understanding Planet-Harboring Stars in the Open Cluster M67

Parker H Holzer (University of Utah); Jessica Galbraith-Frew (University of Utah); Tim Anderton (University of Utah)
*Faculty Mentor: Inese Ivans*

With the many stars found in recent studies to contain planetary companions, many astronomers are now interested in understanding the nature of these planet-harboring stars. To contribute to this understanding, we have studied stars in the open cluster Messier 67 (M67), a cluster known to have many stars similar in their overall chemical enrichment to our Sun, but somewhat younger. At least four stars in this cluster have shown evidence in previous studies to contain planets. We studied these, as well as 34 other unevolved stars in M67, by using high resolution, high signal-to-noise, infrared stellar spectroscopy from APOGEE (Apache Point Observatory Galactic Evolution Experiment; a part of the Sloan Digital Sky Survey, of which the University of Utah is an institutional member). Because stars in an open cluster are born from the same material and approximately at the same time, they are in general expected to all have very similar chemical compositions. However, after using the provided spectra to derive the temperature, gravitational acceleration at the surface, and overall chemical enrichment of the stars in our sample, we find that the chemical abundance determinations for some elements are not homogeneous, but in fact vary from star to star. This spread may possibly correlate to the presence of planet-harboring stars. Our findings suggest that planet-harboring stars are richer in refractory elements and poorer in volatile elements, giving a deeper understanding of the environments in which planets are likely to have formed.

# Running Exercise Mitigates the Negative Consequences of Stress on Hippocampal LTP

Morgan D Homan (Brigham Young University); Jeff G Edwards (Brigham Young University); Zoie Badura (Brigham Young University); Roxanne Miller (Brigham Young University); Tyler Hammond (Brigham Young University); Myriah Lewis (Brigham Young University); Jacob Welch (Brigham Young University)
*Faculty Mentor: Jeff Edwards*

Cognition and memory in the mammalian brain can be impacted by behavior. For example, exercise and stress have positive and negative impacts respectively. While stress is anxiogenic and detrimental to neural function such as memory, exercise in contrast is anxiolytic and improves neural function. In the hippocampus, learning and memory are mediated at the cellular level by synaptic plasticity, known as long-term potentiation (LTP). It is now well established that stress decreases LTP and performance on behavioral memory assays while exercise enhances LTP and memory performance. What is not known however is whether exercise in association with stress can mitigate the negative impact stress has on memory. Therefore, we examined the effect exercise had on stress in the hippocampus using physiological, molecular, and behavioral techniques on C57BL/6 male mice. We conducted experiments on four groups: exercise without stress, sedentary without stress (control), exercise with stress, and sedentary with stress. Field electrophysiology confirmed that stress alone significantly ($P < 0.05$) reduced CA1 hippocampal LTP compared to sedentary controls and that exercise alone significantly increased LTP compared to controls. Importantly, we noted that mice that were exercised prior to stress exhibited LTP that was significantly greater than LTP for mice undergoing stress alone, but were not significantly different from control sedentary mice. Next, we used quantitative PCR to determine the differences in hippocampal mRNA expression of certain proteins that are part of the exercise and stress neural pathways. Specific proteins that were analyzed between the four groups were those in the brain-derived neurotrophic factor (BDNF) pathway, which others have demonstrated are upregulated in exercised mice, and glucocorticoid and mineralocorticoid receptors, which are upregulated in stressed mice. The CA1 region of the hippocampus is associated with spatial memory, so we used the radial arm maze to detect differences in spatial memory between the groups. Differences in time to complete a trial, total distance traveled, and reference and working memory errors between the groups of mice were examined. Collectively, these results are significant as they suggest exercise as a suitable treatment to counteract the negative effects stress has on the hippocampus, specifically memory. By better understanding the neural pathways that are involved during exercise and stress, we can better understand how to use exercise to prevent everyday stresses from having a detrimental effect on cognition.

# Where Fantasy Meets Reality: Commercial Sex Work in the 21st Century

Amanda Howa (Westminster College); Fernando Rivero ; Han Kim (Westminster College)
*Faculty Mentor: Han Kim*

As Internet usage has increased over the past decade, communication has shifted online. This has had consequences on the commercial sex worker industry. There are now numerous websites that host online forums for sex workers' clients to discuss workers and services in countless cities around the world. This has presented a potential data tool that will allow researchers to gather data on an industry and population that have been difficult to research using traditional data collection methodology. Specifically, the study of sexual solicitation ads and reviews found on forums such as "The Erotic Review" and "Backpage" can characterize the sex worker population in specific cities. This observational study characterizes commercial sex work in Salt Lake City, Utah to determine where sex work takes place, how the use of online forums facilitates sex work, and who participates in the services. The project also profiles attitudes towards sex workers, including views on unprotected sexual acts. Specifically, this study analyzes the ethnicity, location, age, physical appearance, internet usage, and sexual services provided of 1,086 women in Salt Lake City, Utah from 2002 to 2014. All data provided on the chosen forums was recorded and tabulated into an Excel file to run statistics and analyzed to determine patterns and changes over time. There is an evident lack of data regarding Utah in particular, and this project therefore aims to provide the first quantitative and qualitative data to begin raising awareness of commercial sex work in Utah. With support from the Utah Trafficking in Persons Task Force, this project generated data to enable local law enforcement and victim advocates to properly and efficiently distribute their resources and their time.

# Soluble Pollutant Concentrations in Fog Water during a Cold Air Pool in the Salt Lake Valley

Will Howard (University of Utah); Dave Whiteman (University of Utah); Steven Hall (University of Utah)
*Faculty Mentor: Dave Whiteman*

Valley cold air pools (CAPs) are a common occurrence in the Salt Lake Valley in winter. Such CAPs inhibit atmospheric mixing and trap all pollutants emitted within the valley in a ground-based stable boundary layer. Unfavorable consequences are realized in the health of citizens, the local economy, and impacts on terrestrial ecosystems. This study investigates the soluble chemical pollutants contained in fog water during CAP events during January of 2015. Fog water was sampled using a passive fog collection device, in which water droplets transported by winds were collected onto quasi-vertical strands of fluorocarbon line (0.165mm diameter) suspended from the top of an open rectangular cuboid constructed of PVC piping, and sited on the North Point Ranch property on the south-eastern periphery of the Great Salt Lake. The cuboid was 2.5 m high, with a 1 m square at its top and bottom, encasing an atmospheric volume of 2.5 cubic meters. Droplets collected on the lines ran down into a funnel, and through tubing into a 1-liter plastic sample bottle contained in an insulated housing. Collected water was then tested via ion chromatography following the vacuum filtering of each sample through 1 µm Whatman Nuclepore membranes. Averaged results from two samples found concentrations of ammonium and nitrate of 2.9 mg/L and 2.5 mg/L, respectively. Ammonium concentrations were nearly four times higher than concentrations from snowpack water in the Salt Lake Valley, as reported by Hall (2014). The nitrate concentrations on the other hand, were nearly equivalent to snowpack concentrations. Atmospheric conditions during the CAP events were observed at the nearby Salt Lake City International Airport at regular intervals. The measurement of the ionic constituents of the fog water could prove valuable in quantifying the impacts of atmospheric pollution on valley terrestrial ecosystems through eutrophication and similar processes.

# Self-Compassion and its Effects on Physical Pain Response

Parker Hughes (Weber State University); Tahne Vongsavath (Weber State University); Tyson Bryant (Weber State University); Shannon McGillivray
*Faculty Mentor: Shannon McGillivray*

The current study examined a potential relationship between the attribute of self-compassion, the ability to show compassion towards oneself, and ability to cope with moderate physical discomfort. Literature has shown that individuals who hold elevated levels of self-compassion are better able to cope with mental and social stressors, but little research has studied a physiological component. This study aimed to examine the potential protective effects of self-compassion on physiological and self-reported responses to pain. Participants were assessed in regard to their self-compassion, and baseline measurements of heart rate and blood pressure were taken. Participants were then instructed to submerge their hand into cold water (four degrees Celsius) for up to three minutes. The subject's heart rate and blood pressure, as well as a self-reported pain ratings (scale from 0-100) were recorded every thirty seconds while their hand remained in the water. It is expected that those with higher levels of self-compassion will display less of a change in physiological responses from baseline and report lower levels of pain compared to those with lower levels of self-compassion. The results from this study may contribute to a better understanding of a relationship between self-compassionate attitudes and ability to respond to and cope with physical stressors. The little amount of research conducted in this area of psychology indicates it is fertile ground for new, interesting, and potentially useful findings.

# Dietary supplementation with tart cherries for prevention of inflammation-associated colorectal cancer in mice

Ashli Hunter (Utah State University); Deanna Larson (Utah State University); Sumira Phatak (Utah State University); Abby Benninghoff (Utah State University)
*Faculty Mentor: Abby Benninghoff*

Colorectal cancer (CRC) is the second leading cause of cancer-related death in the United States, with 143,460 estimated new cases in 2012. Risk for developing CRC is determined by many factors including genetic susceptibility and lifestyle choices, such as lack of exercise and poor nutrition. The typical Western diet is characterized by inexpensive, highly processed foods that are rich in calories, but suboptimal in many essential minerals and vitamins. In this project, we aimed to determine whether dietary supplementation with tart cherries, a functional food rich in anthocyanins, prevents colon tumor development in mice consuming a Western diet compared to a prudent diet. The cherry fruit is a nutrient-dense food with comparatively low caloric content and significant amounts of key nutrients and bioactive food chemicals. Much of the health benefit of cherries is attributed to their high amounts of anthocyanins, which are water-soluble, bioavailable chemicals responsible for the fruit's bright red color. Anthocyanins have antioxidant and anti-cancer properties that contribute to changes in cell signaling pathways involved in inflammation, carcinogenesis and angiogenesis. We hypothesized that dietary supplementation with freeze-dried whole tart cherries would suppress development of colon tumors in a model of CRC that incorporates the typical energy-dense, nutrient-poor Western diet (the TWD)1. A 2x2 factorial design was employed, whereby mice were fed either an optimal diet (AIN93G) or the Western diet (TWD), each with and without Montmorency tart cherry powder added to the diet for a total anthocyanin content of 188 mg/kg diet. Each mouse was dosed with azoxymethane to trigger carcinogenesis within the 16-week study time frame; mice were also provided 1% dextran sodium sulfate (DSS) in their water for 4 weeks to promote colonic inflammation and tumor formation. The most remarkable observation was a significant ($P<0.05$) 40% reduction in tumor incidence in mice fed the optimal diet supplemented with tart cherry powder compared to the control group, whereas tart cherries had no effect in mice fed TWD. Tart cherry powder supplementation did not impact the number of tumors present nor their size. Consumption of the Western basal diet markedly enhanced colitis (40-fold increase in disease activity) and tumor multiplicity (near 6-fold increase) compared to those fed the optimal diet. Addition of the tart cherry supplement did not significantly affect measures of colitis or tumor multiplicity in mice fed either diet. These data contrast with a prior observation by our group that green tea supplementation was effective at reducing development of aberrant crypts only in mice fed TWD.2 These contrary observations point to important interactions between basal diets and dietary bioactive supplements and point to the need for proper consideration of the role of basal diet in dietary chemoprevention studies in rodents.

References 1.Hintze, K., et al. J Ag Food Chem, 2012. 60(27):6736-42. 2.Hintze, K., et al. FASEB J, 2013. 27(Suppl. 1): 863.9

# Chemical composition of ultra-faint dwarf galaxy Bootes I

Julie Imig (University of Utah); Deric Session (University of Utah)
*Faculty Mentor: Inese Ivans*

Old metal-poor dwarf galaxies provide unique tools for studying chemical evolution in the early universe. Several of the Milky Way's ultra-faint satellites show atypical elemental abundance ratios, indicative of a mass bias in core-collapse supernovae through the satellite's history. One such neighbor, Bootes I, has few high-resolution spectroscopic analyses with published abundances, particularly for elements produced in explosive neutron-rich environments such as europium. This study investigates the chemical history of Bootes I using a sample of five candidate stars observed with Carnegie Observatory's MIKE and MagE echelle spectrographs. Atomic absorption line measurements and spectrum synthesis calculations were performed to determine the abundances of elements including iron, magnesium, calcium, and europium. Through these derived abundances, this study seeks a clearer picture of the galactic evolution of Bootes I, which may be a remnant building block from the Milky Way's formation.

# UAV Path-Planning Optimization using Bezier Curves and a Receding Horizon Approach

Bryce Ingersoll (Brigham Young University); Andrew Ning (Brigham Young University)
*Faculty Mentor: Andrew Ning*

Unmanned aerial vehicles (UAVs) are used in an increasing number of applications. UAVs need to be able to successfully complete missions while safely avoiding various obstacles, both static and dynamic. It is also important to optimize the planned path to various criteria, such as energy use, distance, or time. In this presentation we propose an approach where we model UAV flight path planning as a constrained single objective optimization problem. Solving this problems results in an optimized path which successfully avoids obstacles. Such an approach will allow UAVs to be implemented in a greater amount of tasks and missions than before (such as missions with heavy traffic and congested airways), while minimizing the risk to the UAV's and others' safety.

# Human Power Energy Harnessing: A Systems Engineering Approach

Alex Jafek (Brigham Young University)
*Faculty Mentor: John Salmon*

Individuals in developed nations are becoming more conscientious of their choices and respective consequences. These individuals are often in a position to consider and influence global issues, including the global economy and climate, and personal issues such as health and self-improvement. This combination creates a unique atmosphere in which to combine these broad desires to benefit the individual and society as a whole. One potential way of doing this is through a technology that allows users to better themselves as they contribute to global society: human powered equipment (HPE). This study analyzes the both the feasibility and business proposition behind placing modified exercise equipment in public places to enable human energy harnessing. This type of study is necessary in assessing the introduction of any new technology, and is especially important for this technology that relies on high-user interaction. In order to analyze the feasibility of employing HPE in public places a model is developed that is capable of characterizing and quantifying the costs and benefits associated with the technology. Generally the benefits are categorized according to energy harnessing, environmental, educational, health, profit, productivity, and other. The costs are categorized according to the cost of the space, installation, and maintenance. Since these benefits and costs vary depending on the technology's installation location, the technology is assessed in 12 unique locations. These locations are then compared based on their relative merit. Three locations that show the highest total return on investment are airports, trains, and schools. In order to assess the business proposition necessary for this technology's introduction, the study further explores the division of costs and benefits between users, a lead, and partner. With this tool, feasible locations can be further parsed according to the feasibility of their business proposition. Based on the system-level synthesis of these other advantages, introducing HPE technology in public places is determined to be feasible and beneficial both to society in general and to the specific stakeholders investing in this technology. Specific locations where the business proposition and feasibility are both high include: gyms, schools, and airports. This study will present the two tools are necessary to assess HPE: an ability to assess the feasibility and marketability. With these tools, any location can be assessed according to the developed framework. These results are especially significant because they will allow for a smooth and rapid adoption of the technology that has the ability to provide many benefits to individuals and society collectively.

# PTSD In the Veteran Population:Teaching Simulation for Nursing Students

Deven Jennings (Brigham Young University); Stacie Hunsaker (Brigham Young University)
*Faculty Mentor: Stacie Hunsaker*

Project Purpose The purpose of this project is to create a simulation that will successfully teach nursing students to care for a veteran patient experiencing post-traumatic stress disorder (PTSD). Project Importance The veteran population receives health care in various locations outside of Veteran Affairs facilities. Current research supports that 18-30% of veterans suffer from PTSD. Census records show that in 2013, 19.3 million veterans living in the US, this means that nearly 3.5-5.8 million American veterans suffer from PTSD currently (Census.gov, 2014). The need for nurses to become more familiar with PTSD and specific nursing care related to PTSD is necessary to care for the diverse population we find in many health care settings. Project Profile Body Expectation for this Project: The project will help nursing students to fulfill the purposes of the simulation which are: 1) recognize PTSD with its associated signs and symptoms, 2) demonstrate how to implement therapeutic communication to patients experiencing hyper-anxiety situations, and 3) demonstrate knowledge concerning various support groups and treatment options for PTSD treatment and care. Project Plan: The PTSD Simulation will be created based on current research and methods for PTSD simulation seen in the country along with the basic structure provided by the Brigham Young University (BYU) College of Nursing (CON) Nursing Learning Center (NLC). The setup will allow for future simulations to follow a similar formatting procedure. The simulation requires a live actor teaching assistant with pertinent knowledge of PTSD symptoms, a control room teaching assistant to run the vital signs from a control room, 4-6 nursing students to participate in the simulation, and various nursing supplies as outlined in the simulation outline. The simulation will require that participants complete pre-simulation work that will educate students about PTSD and the veteran population. The students will then participate in the simulation as described in the outline. At the simulations completion, participants will be able to recognize the signs and symptoms of PTSD, combat related stress in the veteran population, and therapeutic communication techniques. Methods: We will create a simulation based on the available research concerning PTSD. After a trial run of the simulation, it will be revised according to direct observation from myself and the nursing faculty simulation coordinator, as well as participants' comments and evaluations. Anticipated Academic Outcome Together with Stacie Hunsaker, I will create a simulation that will be applied to the Psychiatric and Mental Health Nursing curriculum. The simulation will prepare nursing students to recognize and care for veteran patients experiencing PTSD. The trial simulation will be completed by December 2015. The project's final result will be presented to the NURS 461, Psychiatric and Mental Health Nursing, professors for approval and possible application into the course curriculum.

# The effects of Umbellularia californica produced terpenoids on vascular smooth muscle

Bodrie Jensen (Southern Utah University)
*Faculty Mentor: Matthew Weeg*

Many plants produce chemicals called secondary metabolites that act as defense mechanisms against herbivores and pathogens. A large portion of these secondary metabolites belong to a chemical class called terpenoids. These terpenoids have been shown to affect the cardiovascular system, specifically causing vasodilation. The tree Umbellularia californica is an aromatic tree, producing an essential oil that has been linked to headaches in those who stand near it for too long. The essential oil is comprised of terpenoids including umbellulone, eucalyptol, and terpinen-4-ol. Previous research has shown that when the essential oil from U. californica is applied to cutaneous blood vessels in frogs, significant vasoconstriction is seen. Our research aims to determine why these terpenoids are creating a vasoconstrictive effect, opposite to the current knowledge about terpenoids and their vasodilation properties. Our goal is to establish which of the three terpenoid compounds is causing this difference in vasoactivity. In order to do this, we will apply each terpenoid individually to frog blood vessels and measure the change in vessel diameter. After applying each terpenoid individually, we will then apply different combinations of the terpenoids to determine possible synergistic effects, again measuring for vessel diameter change. We believe that each individual terpenoid will have a vasoactive effect leading to vasoconstriction, but the combination of the terpenoids will lead to more vasoconstriction than any individual terpenoid.

# Does a Heart Build Itself? A study in cardiomyocyte cell differentiation

Kaitlyn Johnson (Brigham Young University)
*Faculty Mentor: Alonzo D. Cook*

Despite developments in modern technology for heart disease treatment and prevention, heart disease remains the number one cause of death in America. With an inability to meet an ever increasing demand for heart transplants, any potential alternative must be pursued. Engineering porcine hearts to create whole hearts suitable for transplant is an incredibly promising solution. In the Dr. Alonzo Cook's lab at Brigham Young University, we have successfully developed a novel heart decellularization process (Momtahan 2015), as well as succeeded in producing beating, human pluripotent stem (IPS) cell-differentiated cardiomyocytes on a 1 cm disc of cardiac extracellular matrix (cECM). In order to progress towards a 3D, recellularized cardiac matrix, we are further investigating possible conditions to create a more cohesive cardiac matrix. As the field of research using human IPS cells on porcine matrix is largely unexplored, this research is designed to explore the role that both porcine cECM and porcine urinary bladder matrix (UBM, ACell, Inc.) have in differentiating IPS cells into functioning, beating cardiomyocytes. We hypothesize that the presence of cECM in undifferentiated IPS cells will initiate IPS differentiation into cardiomyocytes, while presence of UBM will result in little to no differentiation. We will measure the effect that cECM and UBM have on IPS cells by comparing genomic properties of the IPS cells in maintenance medium (negative control) and differentiation medium (positive control), with IPS cells in maintenance medium containing cECM powder, and in medium containing UBM powder. We will conduct three trials of each test, using four six-well plates of IPS cells set on vitronectin, as is standard. After 14 days, we will perform RNA-SEQ on each of the 18 tests. RNA will be extracted using IlluminaTruSeq RNA Library Preparation kit and cDNA libraries prepared using the Illumina TruSeq library kit. After sequencing, results will then be aligned to the human genome using the STAR alignment program (Dobin et al., 2012), and assigned to genomic features (i.e. genes) using the RSubread package (Liao et al. 2013) for the R statistical programming language. If the cECM or UBM test does, in fact, express significant amounts of cardiomyocyte genes, then differentiating IPS cells in the presence of the corresponding matrix quite possibly will help produce more mature cardiomyocytes. This will be revolutionary for the heart recellularization project, lending a stronger beating function to a more cohesive recellularized matrix. If UBM, in particular, contributes to the differentiation of IPS cells towards cardiomyocytes, we will have discovered a novel application of the product.

# Personal susceptibility to media influence: Body satisfaction in sub-clinical women

Erin Kaseda (Brigham Young University); Jordan Sgro (Brigham Young University); Adriane Cavallini (Brigham Young University); Kiley Ballew (University of Nevada, Las Vegas); Spencer Nielson (Brigham Young University); Kristen Ray (Brigham Young University); Chris Herron (Brigham Young University); Kyle Eversole (Brigham Young University); Katie Hyatt (Brigham Young University); Wendy C. Birmingham (Brigham Young University)
*Faculty Mentor: Wendy C. Birmingham*

Background: Previous research has examined eating disorders (EDs) in regards to media consumption and exposure to thin-ideal images. However, much of the literature experimentally examines the effect of media images on body dissatisfaction and eating disorder symptoms without accounting for self-reported susceptibility to media influence. Many individuals with ED sub-clinical symptoms, including body dissatisfaction, eventually develop full syndrome Anorexia Nervosa (AN) or Bulimia Nervosa (BN). Method: In the present study, we examined the association between marital relationship quality (RQ) and ED symptoms in 24 sub-threshold mostly white (98.8%) married women ages 18-50 (M=30). We assessed overall body satisfaction with the Body Assessment Questionnaire (BAQ). Interviews were then conducted to ask more in depth questions about their body image and how they felt the media influenced image-based self-esteem. Results: Most women (58%) were, overall, dissatisfied with their bodies and 78.5% of women who were unsatisfied with their bodies also stated that the media negatively impacted their self-image. Most (95.8%) reported that media images of women could have a detrimental effect on body image; however, close to half (41.6%) stated that they personally were not negatively affected. Of those who reported they were not affected, most (70%) were satisfied overall with their bodies. Conclusions/Significance: Our results demonstrate that there is a correlation between personal susceptibility to media images and body satisfaction. Women who claim that they are not negatively affected by media body image ideals are more likely to be satisfied with their own bodies, while the reverse is also true - women who feel discouraged, judged, or dissatisfied with themselves in comparison to media body image standards are also more likely to be unsatisfied with their bodies overall. These results suggest that ED interventions at a sub-clinical level could be successful by focusing on personal susceptibility to media influence.

# Black Female Mentors at Predominately White Institutions: Cultural and Academic Adaptation

Morgan Kirk (Dixie State University)
*Faculty Mentor: Christina Duncan*

When discussing Black women at Predominantly White Institutions (PWI) there are fundamental items which must be understood. First, we must understand that Black women have unique position in academia specifically at PWI's; it is important for these women to utilizing their lived experience from the structure and gain an understanding that the content of their lives is not only historical but also conditional in building their place within PWI's. Second, Black women have a lived experience that can be translated within group, even in different space and time. Third, due to this unique lived experience, Black women also experience universal themes within the context of their lives both inside and outside of academia. This research plans to gain an understanding of the above fundamental ideas in relationship to Black female mentors and mentees at PWI's and the resulting cultural and academic adaptation that exists when doing so.

# A Weekend in the Wild: Effects of Nature on Creativity

Cinimin Kofford (Utah Valley University); Sean Brodrick (Utah Valley University); Kevin Willett (Utah Valley University); Drew Mendenhall (Utah Valley University); Josiah Westfall (Utah Valley University); Michael Bohne (Utah Valley University)
*Faculty Mentor: Ellis Jensen*

Technology rich conveniences have had a negative impact on human creativity and cognition, thus producing a need to further understand the depth of how detrimental tech-dependance has become and how we can attenuate identifiable deficits; recently, researchers measured improved creativity and cognition in participants after spending 4-6 days in nature and away from modern technology (Atchley et al. 2012). The forty-hour work week can prevent people from spending extended periods of time in nature, such as in Atchley et al. For convenience purposes, people are more likely to spend a quick two days in nature than plan ahead for a four day trip. The purpose of this study, was to understand if technology deprivation in nature is as beneficial after two days as it was after four. We hypothesized that the enhancing benefits of nature on creativity and cognition while being deprived of modern tech (i.e. multi-media devices, cell phones, laptops, tablets), would be observed in a two day period of time. We assessed creativity and cognition using the Remote Associates Test (RAT) which was administered before and after the weekend. Two days in nature and without electronic devices, failed to significantly increase creativity in our participants. However, a trend ($p=.130$) for improved cognition and creativity was identified. While one weekend in the outdoors did not yield the anticipated improvements in our study, real benefits may be observed if the study were expanded to include more participants. Perhaps exposure during one isolated weekend is not enough, but benefits may be obtained if participants were to recurringly have a natural retreat every weekend or twice a month. If two days in the wild continued to prove insufficient to elicit real cognitive benefits, then the current trend may suggest that benefits could be obtained after three days in the wild. The cognitive benefits received from time spent in a natural setting lacking technology should not be overlooked, and perhaps benefits are occurring at a quicker rate than 4-6 days as concluded in prior research. Despite the lack of statistical power behind this chosen research method, the small improvements identified through our studies are promising and indicate that the benefits that can be obtained through experiencing the great outdoors are multifaceted, positively affecting one's creativity, cognitive capabilities, and overall wellbeing.

# Group Strength vs. Individual Effort

Casey Koldewyn (University of Utah); Adriana Haws (University of Utah); Vic Schiffman (University of Utah); Shaylee Tulane (University of Utah)
*Faculty Mentor: Cathleen Power*

In a society that values individual prowess and abilities over group-strength, Western ideals of masculinity create competition amongst men, and pit women against each other in struggles for socially defined, male-ascribed traits. For our purposes, community engaged learning is defined as the intersection of out-of-class work with the community and in-class learning to create a bridge between academia and real-world experiences. This creates a synergistic system where both parties gain valuable insights through the form of much-needed services and practical application of theories and discourses learned in the classroom. Community engaged learning is an underutilized medium for students to learn pragmatic purposes of their learning, as well as develop real-world skillsets. With an epidemic of social problems encroaching on us every day, we need to be able to address issues as a community, to provide alternate solutions aside from those attempted individually that have not proven to be ultimately successful. We are a group of young women at the University of Utah enrolled in a course that focuses on community engaged learning. We hope to study the ways in which our experiences with this course influence the way we value group-strength over individual prowess and ability in our daily lives to better understand how such courses could be utilized in other college classes and in the lives of all college students more generally.

# The Effect of Microbiota on Lifespan in Drosophila melanogaster

Melinda Koyle (Brigham Young University); Madeline Veloz (Brigham Young University)
*Faculty Mentor: John Chaston*

Almost all animals are affected by the bacteria found in their intestine. Recent research has begun to show the close relationship hosts have with their microbiome. These interactions influence metabolic, respiratory, nutritional, neurological, and immunological functions along with many other biological roles. With short lifespans and comparable gut anatomy to humans, fruit flies make an excellent model organism for studying host/microbiome interactions on lifespan. We developed a two-step design to identify microbial genes that influence lifespan of the fruit fly Drosophila melanogaster. First, I tracked the influence of 42 different strains of bacteria on D. melanogaster lifespan by inoculating fly eggs with one strain and then measuring the lifespan of the flies. Lifespan data were collected for three separate experiments, each with 9 replicates per bacterial strain, leading to individual lifespan measurements for ~ 50,000 total flies. In the second step, we analyzed the data using a computational pipeline to predict genes in the bacteria that affect host lifespan. The end result of this analysis is a list of bacterial genes and p-values indicating whether the presence of the gene is predicted to have strong influence on D. melanogaster lifespan. Once the analysis is complete we will confirm predictions of the pipeline by mutant analysis. We anticipate that describing how microbes influence D. melanogaster lifespan will enlarge our understanding of the relationship between lifespan in humans and our own microbiome.

# Dynamic Autophagy in the Insulin Resistant Heart

Kathryn Lami (University of Utah)
*Faculty Mentor: Sihem Boudina*

Heart disease is the leading cause of death among people with diabetes. Cardiac failure morbidity rates nearly exceed morbidity rates of cancer. There are several mechanisms proposed to influence cardiac failure, such as altered cardiac autophagy. Autophagy is the catabolic pathway in which damaged organelles and proteins are degraded via lysosomic activity. Previous studies have shown that impaired autophagy resulted in cardiac failure in mice. The pathological role of autophagy in the insulin resistant heart is largely unknown, because of the limitations of measuring autophagic flux. Autophagic flux, or dynamic autophagy, reflects the process of the formation of the autophagosome, engulfment of damaged particles, and fusion of the lysosome for degradation. Our previous results via static imaging have shown a decrease in LC3I/LC3II lipidation, but this ratio could be a result of impaired lysosome fusion rather than impaired autophagy. By inhibiting lysosome fusion via Chloroquine, we were able to continue our research on dynamic autophagy in the insulin resistant heart. We hypothesized that reduced insulin resistance led to decreased autophagy. Our objective of this study was to measure the autophagic flux in the heart, as well as investigate the mechanisms involved in cardiac autophagy. We used a Total Insulin Receptor Knock-Out (TIRKO) mouse model to represent our diabetic group. We injected the mice with Chloroquine and harvested the heart tissue. Using Western Blot technology, we probed the membranes with 4 different antibodies: LC3B, ATG3, GAPDH, and Sequesterome/p62. Our results showed that there are increased levels of LC3I and P62 in the Chloroquine-treated mice, indicating that there is a lack of LC31/LC3II lipidation occurring and thus autophagosomes are not being formed. These results indicate that the autophagic pathway is impaired in the insulin resistant heart, which could influence cardiac health of diabetic patients.

# Purposeful Living

Bridget Larsen (Weber State University)
*Faculty Mentor: Kristen Arnold*

IF...you provide a place where people feel welcomed, comfortable, warm, relaxed, and safe, THEN...they will want to sit and visit, share memories, interact, and invite others to join them. George E. Wahlen's Veteran's Home in Ogden, Utah was established to care for our nation's heroes with dignity and honor. These heroes need a place to come home to, an environment that is inviting, designed to encourage interaction. It is my intention to infuse this brick and mortar building with life, energy, and purpose, specifying surroundings that entice all of the senses but maintain a harmonious balance. By creating a place with purpose, morale will be enhanced. The veteran's home needs a harmonious overhaul. Studies link the physical environment to patient and staff outcomes. A well-executed layered lighting plan is absent from this building. "Natural and artificial lighting improve health outcomes such as depression, agitation, sleep, circadian rest-activity rhythms, as well as length of stay in dementia patients and persons with seasonal affective disorders" (Wallace & Guy 2002). Changing the color pallet from beige on beige to a home filled with earth tones would improve the overall energy to the veteran's home and give them the residential feel they are outright desperate for. "Heart-surgery patients in intensive care units that were assigned a room with a landscape scene with trees and water reported less anxiety/stress and needed less pain medicine than a controlled group assigned with no scenery" (Ulrich 2004). Outdoor spaces are empty and unattractive. Grand covered patios with exponential amount of opportunities to provide an area for gathering and purposeful activities are desolate. "Hospital gardens provide restorative, calming nature views and can reduce stress while improving outcomes through other mechanisms such as: fostering access to social support and providing opportunities for positive escape and sense of control with respect to stressful clinical settings...Nurses and other healthcare workers used the gardens for achieving pleasant escape and recuperation from stress" (Cooper, Marcus, & Barnes 1995). Special mementos and historical attributes are important heartfelt pieces that should be incorporated cohesively. Mannequins in the foyers shed an uncomfortable retail effect on this heroic home, inadvertently shadowing the honor earned amongst those that sacrificed so much. "A consistent pattern has been proven that patients, staff, and visitors respond positively to representational nature, but react negatively to chaotic design and artwork. In fact, inappropriate art styles and these chaotic design settings increase stress and worsen outcomes" (Ulrich & Gilpin 2003). Space planning could not be more imperative to this setting. It is what outlines the livelihood of their home. "Strong evidence proves that comfortable furniture, moveable seating, and carpeting enhance social interaction as well as eating habits in geriatric patients" (Melin & Gotestam 1981).

# Identification of Components of Visual Circuits Within the Cerebral Cortex of Primates

Hanna Larsen (University of Utah); Jeff Yarch (University of Utah); Alessandra Angelucci (University of Utah)
*Faculty Mentor: Alessandra Angelucci*

Visual perception is thought to occur via different processing pathways in the brain. The dorsal pathway is involved in motion processing, while the ventral pathway is involved in processing the form of objects (Ungerleider & Mishkin, 1982). Primary visual cortex (V1) is the first cortical area that receives information from the eye. Neurons in V1 project to area V2, which then distributes information into either the dorsal or ventral processing streams. By understanding how V1 and V2 are wired together, we can understand what kinds of information from the eye are flowing into each of the visual pathways, thus allowing us to investigate how the brain constructs our visual perception of the world. In this project, we are looking at the kinds of cells in V1 that provide information to different functional areas in V2 (known as stripes: thick, thin, pale-medial, pale-lateral). We are specifically looking at two kinds of neurons (spiny stellates, pyramids) in layer 4B (L4B) of V1. These L4B cells have been show to receive different kinds of input; stellates receive input useful for motion processing, while pyramids receive input useful for processing the form of objects. Surprisingly, it was recently shown that a motion area of the brain, MT, receives about ~80% stellate and ~20% pyramidal input from L4B. It was also shown that area V2 received ~80% input from pyramids, and ~20% from stellates (Nassi & Callaway, 2009). In that study, the investigators did not look at the input from V1 to the specific stripe areas of V2, which is the goal of this project. To label L4B neurons that project to specific V2 stripes, a modified rabies-GFP virus is injected in vivo into a V2 stripe in an anesthetized macaque monkey. After ~5 days post injection, animals are euthanized, brains are sectioned at 40μm, and then processed immunohistochemically to reveal labelled neurons. Neurons are digitally reconstructed across serial sections using light microscopy and Neurolucida software. The percentage of spiny stellate and pyramidal cells going to thick stripes in V2 was found to be ~50% stellate and ~50% pyramidal. This differs from the previous findings and is important because it shows that one function of thick stripes is to integrate equal amounts of form (pyramidal neurons) and motion (stellate neurons) information, which was previously unknown. Additionally, thick stripes project into the dorsal stream, and our data show an unexpected contribution of 'form' information to this pathway. Currently, we are studying the proportion of each neuron type projecting to thin stripes. We hypothesize that there will be a higher percentage of pyramidal neurons projecting to thin stripes because thin stripes are known to project into the form processing ventral pathway.

# Feasibility Study of Technology for Increasing Sustainability at Airports

Shelby Larsen (Brigham Young University); John Salmon (Brigham Young University)
*Faculty Mentor: John Salmon*

Airports are raising the bar in energy sustainability by implementing changes to their economical expenditures, ecological footprints, and social interaction with passengers and community. With increased levels of energy efficiency, airport systems are more productive, enabling more flights and passenger traffic with reduced expenditures as well as fewer flight delays. The purpose of this study is to evaluate technologies that would improve or optimize various aspects in and around the airport. Airports have a large influence on local economies and surrounding communities, as well as domestic and international travelers. These communities as well as millions of passengers will see the positive outcome of these changes. Solar and wind power are newer technologies currently transforming society in various ways. These alternative energies, if installed on a massive scale could offset the majority of the airport's energy cost. Terminals now consume forty percent or more of the airport's total energy. Additional technology, such as light and conveyor sensors, would reduce this energy requirement dramatically. Water usage can be reduced with low-flow and sensored water appliances and storm water retention can offsets this usage. Additionally, the collected surplus is then used to water airport greenery and wash rental cars. Social outreach programs sponsored by airports can also improve community relations. Tenant agreements would contain minimal performance standards for recycling and waste management. Wireless internet available throughout terminals with 'you are here' map apps would increase terminal traffic flow and minimize passenger confusion. This research explores and evaluates a number of feasible technologies to increase the sustainability of the Kansas City International (KCI) Airport. Based on the literature review, modeling efforts and technology investigations, it has been found that KCI requires 100 Megavolt amperes transformers to meet its energy demand. To offset this cost, thousands of solar panels covering many acres of land would be required. Although the necessary land would be substantial, KCI has the area to develop this solar project in multiples phases. Furthermore, Kansas City is located in the center of America's wind tunnel, where there is great potential in wind energy expansion. Open land on the outskirts of the airport's southwest property would be sufficient for a wind farm. On average, KCI uses 1.4 million gallons of water per day. With low flow and sensored water appliances, the airport has the potential to save sixty percent of this water level. Finally, making terminals easier to navigate and less delayed flights would improve overall passenger satisfaction. Although the investment would be substantial, the benefits from the technology to increase sustainability at KCI and at other airports are both feasible and affordable with a long-term perspective.

# IMPROVEMENT OF CARE IN THE SURGICAL INTENSIVE CARE UNIT THROUGH FAMILY FEEDBACK

Avani Latchireddi (University of Utah); Wade Mather (University of Utah); Joseph Tonna (University of Utah Healthcare)
*Faculty Mentor: Joseph Tonna*

IMPROVEMENT OF CARE IN THE SURGICAL INTENSIVE CARE UNIT THROUGH FAMILY FEEDBACK Avani Latchireddi, Wade Mather PI: Joseph Tonna, MD, FAAEM Purpose This research project is to assess patient satisfaction and feedback around care provided in the Surgical Intensive Care Unit (SICU) at the University of Utah Hospital with the goal of iterative improvement of care. Research Question/ Hypothesis We hypothesize that by assessing patient satisfaction of ICU care, we can implement directed changes targeting patient-identified concerns. Methodology A survey of 37 questions, based on a validated national survey of family satisfaction with ICU care (FSICU-24) was put together addressing issues ranging from emotional care to technical aspects of the SICU experience on a whole. It is administered to the family member who was most involved in the patients care in the Surgical ICU after transfer out of the ICU. All the data is securely maintained and analyzed through a REDCap database for the purposes of quality improvement. Observations Over the initial weeks of administration, a few observations for improvement opportunities have been repetitive. • Many patients and family members highly appreciate their attending doctors but cannot keep track of their names with the many teams of doctors. • Having a time frame in which the doctor would arrive on rounds such that the family member can be present would be very helpful. • The family members of patients sometimes feel uncared for in the SICU. Many would appreciate having someone show them the cafeteria or simply ask them if they need anything in particular. • The plan of the day sheet (checklist as well as a list of the medical plan the team intends to follow) is often not given and/or explained to the patient and their family. Conclusion The following changes will be considered for feasibility of implementation. Surveys will be continuously administered in order to observe the effect the implemented changes have had. For example, changes might include the nurses explaining the plan of the day sheet to the patient and their family after the doctor has stated the plan of care; having picture cards of doctors with their name and photo would help patients and families better identify their caregivers; a volunteer could go around the ICU once a day and ask if the family has any needs. The expectation is to see improved patient and family satisfaction in those selected areas.

# β-cell Adaptation to Elevated Palmitate Concentrations (Hyperlipidemia)

Daniel Lathen (Brigham Young University)
*Faculty Mentor: Jeffery Tessem*

It is estimated that over 370 million people worldwide suffer from diabetes, and this number is increasing rapidly. Normally, β-cells in the pancreas secrete insulin, which is necessary for proper glucose absorption and storage. Both Type 1 and Type 2 diabetes are characterized by decreased functional β-cell mass and insulin production, and increased circulating glucose and fatty acid levels. Diabetics' pancreata maintain small amounts of functional β-cells, but these surviving cells are damaged and destroyed over time due to the harmful effects of hyperglycemia and hyperlipidemia. These β-cells must adapt to survive. Hence, diabetes is itself a selective process. We have mimicked and analyzed this selection process in vitro by culturing β-cells under conditions of increasingly elevated palmitate concentration applied step-wise, creating distinct cell lines acclimated to various levels of palmitate concentration with corresponding control lines. Through analysis of these lines, we aimed to simulate the gradual progression of hyperlipidemia seen in diabetic patients, and thus determine mechanisms and effects of β-cell adaptation to these conditions. Respiratory control ratios (RCR) suggest that β-cell lines adapted to higher palmitate concentrations do not adversely affect mitochondrial functionality, and Oroboros (O2K) analysis in fact implies increased cellular respiration in these cell lines. Importantly, cell counts and RT-PCR indicate that both β-cell proliferation and expression of key β-cell function and survival genes, especially Nr4a1 and Nr4a3, are up-regulated when cells were treated with low (0.15 mM) concentrations of sodium palmitate, but down-regulated at 0.3 mM palmitate and higher. These data imply that β-cell proliferation is modulated by expression of Nr4a1 and Nr4a3, both of which appear to be boosted by low-level exposure to palmitate but inhibited by excessive exposure. These results represent a significant step towards understanding the causes and effects of this transition, ultimately promoting investigation into methods by which endogenous β-cells could increase cellular function, survival, and proliferation under hyperlipidemic conditions.

# A Wearable Piezoresistive Interface to Virtual Reality

Shawn LeBaron (Brigham Young University); Adin Martineau (BYU); Benjamin Hilton (BYU); Sarah Fletcher (BYU); David Fullwood (BYU); Anton Bowden (BYU)
*Faculty Mentor: Anton Bowden*

Purpose of the Research: 3-D immersive environment (i.e, Virtual Reality) is rapidly approaching integration with our everyday lives. However, the way people interact with a 3-D immersive environment is still problematic. Handheld game pads are invisible in the virtual world; camera-based motion tracking methods limit the users space of motion; and eye-tracking methods are prone to false targeting (e.g., the Midas effect). Recent advances in nano-composite strain gauges have enabled a novel solution to this problem. Nickel nano-strand/silicone composites exhibit piezoresistive properties over a wide range of deformation (up to 100% strain). The purpose of the present work was to utilize these novel sensors to develop a novel wearable virtual reality interface that avoids the disadvantages of current solutions. Research Methodology: A standard engineering design methodology was utilized to identify the functional requirements of the design problem. Various engineering designs utilizing the piezoresistive sensors were evaluated and ranked to identify a final design that met user needs while optimizing function. Results: The final design is a wireless, wrist-mounted, computer interface leverages these nano-composite sensors to measure the natural movement of the wrist using a microcomputer. The design consists of several nano-composite strain gauges that are mounted along distinct axes of the wrist. Each gauge measures wrist motion along that axis. A small current (micro-amps) flows from a coin-cell battery through each strain gauge, which changes its resistance in accordance with the magnitude of the wrist motion. The strain gauge signals are directly input into a small microcomputer that processes the data and transmits it wirelessly to a nearby computer or smartphone in order to provide interactive control of virtual reality environments. Conclusions and Significance: Based on preliminary testing of our prototype design, we are able to provide intuitive control of virtual reality environments without the need for staying within a confined physical space. Our eventual goal is to be able to attach additional sensor interfaces to various parts of the body and use natural body movement to control the 3-D immersive environment. Applications of this technology include entertainment, medical diagnostics, athletic motion evaluation, and even virtual physical therapy training.

# Predicting Cancer Patient Survival by Analyzing Clinical and Molecular Data using a Machine-learning Approach

Terry Lee (Brigham Young University); Stephen Piccolo (Brigham Young University)
*Faculty Mentor: Stephen Piccolo*

As the second-most common cause of death in the United States, cancer affects millions of people each year. A better understanding of the cellular processes that influence cancer development and treatment outcomes could help to reduce cancer's prevalence. Datasets with clinical and molecular data from thousands of cancer patients' tumors have recently been made available to the public through the NIH-sponsored The Cancer Genome Atlas (TCGA). These datasets allow researchers to test relationships between molecular measurements from a patient's tumor and the patient's clinical outcomes, such as how long they survive after being diagnosed with cancer. By identifying such patterns, we may be able to predict how long a patient will survive after diagnosis and gain insights into why some tumors are more aggressive than other tumors. The use of "machine-learning" algorithms to predict patient survival has been reported in recent studies. Such algorithms help to account for the size and complexity of modern biological datasets. However, these studies have yet to consistently produce predictions at accuracy levels that would be clinically useful. A central question remains: can such data be clinically useful? Therefore, we are testing additional machine-learning methods to improve prediction accuracy. First, we are combining evidence across multiple algorithms into ensemble predictions. Second, we are using a new approach to training the algorithms that excludes patients with survival times in the 33rd-66th percentile. Previous studies have been limited to one or a few cancer types; we are studying 14 cancer types. Overall, our analysis includes 6 types of molecular data for about 3,000 patients. We have prepared an analysis pipeline that allows us to assert the validity of our computational tools by comparing our preliminary results to a 2014 study. These results differed only by 1%, which indicates that our pipeline produces valid results. We are now using this pipeline to apply our novel methods to these additional cancer types. Our study is valuable to the scientific community by identifying ways to make sense of the large and complex cancer datasets that can now be generated using high-throughput technologies. Ultimately, this could provide physicians with a tool to better assess the aggressiveness of a patient's cancer and respond accordingly.

# Using Self-Reported Negative Emotions to Predict Key Health and Weight Measures Among College Students

Ting-yi Vicky Liao (Utah Valley University)
*Faculty Mentor: Ron Hammond*

Background: The relationship between negative emotions and emotional eating which contribute to a variety of unwanted health behaviors and outcomes which has been established in literature (see Crockett, Myhre, and Rokke 2015; Canetti, Bachar, and Berry 2002; and Raspopow, Matheson, Abizaid, and Anisman 2013). Purpose: To test the comparative difference between college students who had high self-reported negative emotions (Guilt, Shame, and Sadness) and those who had low ones. Method: An IRB approved study of 274 college students yielded personal information about their health history via a survey and anthropometric measures were taken by using body circumference values and measuring weight. Data analysis included descriptive, correlational, and T-Test analysis (setting $p \leq .05$ as the criteria for acceptable significance levels). We focused separately on two variables and put them into two groups (GGS & NES): Those that felt significant guilt or shame about eating (actual number of days last week) and those that felt significant sadness or negative emotions (actual number of days last week). Results: Findings indicated that the high negative emotion groups scored worse in almost every desirable health practices (for example reading food labels or modifying meals) and current health measure (for example BMI or last three years weight). They scored worse than those who lack negative emotions. Discussion: Both groups scored better on few variables, those variables were important because they were trying harder to read food labels, track their calories, check their weight, modify their meals and modify their diet. Yet, they still scored worse on most other crucial measures such as stress levels, sedentary activities, BMI, and actual weight over the last 5 years. In the future, clinicians and health promoters would benefit from a more careful examination of the influence of these negative emotions on protective and corrective health activities among college students.

# Developing a Transversal Post-Tensioned Structural System

Katja Lund (University of Utah); Scott Thorne (University of Utah)
*Faculty Mentor: Ben Hagenhofer-Daniell*

Wood as a building material has gained popularity in recent years as its sustainability, aesthetics, and overall contributions to good health are increasingly recognized. Wood is a renewable resource when harvested sustainably. When used as a permanent building material, wood also has the ability to sequester carbon. Wood in heavy or solid timber applications provides thermal mass which leads to wood buildings that are "breathable" and thermally stable creating an increase of indoor air quality. The research we are conducting has been ongoing since Summer of 2015. We are investigating the processes and methods involved in post-tensioning heavy timber into a structural element. This approach will allow the form of a building or installation to take on more organic curves, create unique functional details such as integrated seating, and make use of otherwise nonstructural waste wood. Though the research process we will answer three main questions associated with the production of post tensioned heavy timber. First we will need to determine the maximum radius of curves that can be accomplished. Second, though calculations and testing of various curvatures the strength of the structure will be found so elements can be adjusted to maximize performance. The final question that will be researched is how to convert physical components into digital elements and then back into a physical form. To date, we have researched several different forms of data capture, including 3D laser scanning, photogrammetry, and manual measurements. Along with these methods, research has led into interesting fields of 3D modeling, scripting, and 3D printing. Each new discovery has opened new avenues of possibility, bringing us closer to our goal of scanning, modeling, milling, and constructing a post-tensioned installation in full scale through the CAD to CAM process. Our current focus involves the empirical testing of shear strength in key geometries to determine the best timber-to-timber surface detailing in a post-tensioned system. With this information, we will be able to digitally modify the 3D models of our scanned logs or timbers so the millwork can be completed accurately and the finished structure will have the best structural integrity possible at this stage. Building on these findings, we will produce refined full-scale wall section prototypes that demonstrate the system in application. This research bridges the knowledge of innovative wood construction systems and new methodologies in architectural design. Our long-term goal is to determine a suitable and flexible method by which timber can be cut and assembled using a post-tensioned cable system for a variety of project types and design criteria. The end goal is to develop a large scale prototype using python scripted design tools, tested connections, and 5-axis CNC-milled timbers, in an integrated CAD to CAM workflow.

# Hyaluronan-based sustained delivery of the antibiotic besifloxacin to the eye

Shirley Luo (University of Utah)
*Faculty Mentor: Barbara Wirostko*

Corneal ulcers, an ocular emergency and can be a cause of blindness globally if not effectively treated, require topical antibiotics delivered via a very inconvenient hourly, round-the-clock, multiple-day administration regimen to prevent corneal vision loss. These eye drops must be compounded off- label, are difficult to reliably administer, and can suffer from low availability of therapeutic agent due to tears and blinking. This study focuses on the development of a topical hyaluronic acid (HA)-based biodegradable film designed to deliver besifloxacin on a sustained-released (SR) basis to overcome today's dosing challenges. Prototype films of cross-linked, thiolated carboxymethylated HA (CMHA) containing besifloxacin were produced and evaluated for in vitro drug release. Films were fabricated in silicon molds using 16 mg/ml CMHA and poly(ethyleneglycol) diacrylate (PEGDA), as a cross-linker. The polymerized gel was dried at 37°C overnight to create thin films. Various amounts of besifloxacin (up to 150 μg/film) were formulated into the polymer solution prior to cross-linking. The release rate was monitored in phosphate buffered saline (PBS) by measuring UV absorption at 293 nm. Released amounts were calculated from the besifloxacin standard solution. Results show that besifloxacin can be continuously released from films for up to 9 days (on Day 9, approximately 1 μg was released from 150 μg loading). In vitro efficacy tests on the released besifloxacin are currently in progress. In conclusion, Jade Therapeutics' besifloxacin-loaded films represent a promising alternative to hourly antibiotic eye drops, and have the potential to move forward into in vivo studies and ultimately become a clinically useful product. Furthermore, this polymer-based system can be expanded to deliver other antimicrobials to treat additional indications such as ophthalmic fungal or viral infections.

# Optimization of Phenol-Formaldehyde Resins with Bio-oil and Amino Acid Residues

Scott Lyle (Utah State University); Michael Castle (Utah State University)
*Faculty Mentor: Foster Agblevor*

Phenol-formaldehyde resins (PFR's) have been used industrially for decades due to their high bonding strength, usefulness in a broad array of industrial niches, and resistance to water degradation [2,5,6]. Despite their widespread and established status, numerous attempts have been made to overcome the adverse health effects they can cause. In fact, both phenol and formaldehyde are identified as toxic chemicals and may cause a number of health problems. Formaldehyde is classified as Level 4 (out of 5) based on its monomer hazard score, and the formaldehyde-based polymers are ranked among the most hazardous in their class [3]. Phenols have been documented to affect reproductive health in mammals in addition to several other of their known toxic capabilities [1]. It has long been known that wood pyrolysis oils (bio-oils) have high phenol contents [4]. Therefore, these bio-oils have been used by others as a source of phenolic compounds to make PFR's [8]. Using pyrolysis oils has an economic benefit in addition to posing less of a health risk than using pure phenol [8]. Based on primary data, Dr. Agblevor, observed that soy protein can serve as a substitute for formaldehyde. Furthermore, other researchers have had success in using soy protein with phenol-formaldehyde resins [6]. In order to explain the previously described phenomenon, isolated amino-acid residues that are found in high concentrations in soy protein were used. From analysis of the soy protein's amino acid profile, we used Aspartic Acid, Glutamic Acid, and Arginine [7]. Based off the Fourier Transform Infrared Spectroscopy (FTIR) analysis and 3-point flexure tests, Glutamic Acid and Arginine outperformed Aspartic Acid considerably. Glutamic Acid showed substantial adhesion properties, indicating that Aspartic Acid was likely affected by the steric hindrance of the carbonyl termini. The bonding strength of the isolated Glutamic Acid resins appeared to outperform the Soy Protein resins discussed earlier. These results open up the possibility to predict which protein sources should serve as the best crosslinking agents in a PFR modeled system.

# Evaluation of the Stereochemical Selectivity of the Nucleophilic Addition Reaction of the Menthylmagnesium Chloride Grignard Reagent with Electrophiles

Rebecca L. Maedgen (Southern Utah University); Nathan S. Werner
*Faculty Mentor: Nathan S. Werner*

Menthol is a natural product isolated from mint leaves and is the active ingredient found in cough drops. It is a six-membered carbon ring that contains three substituents: an alcohol, isopropyl, and methyl group. Six-membered rings exist primarily as an equilibrium mixture of two chair conformations that minimize angle and torsional strain. These conformations for menthol are not degenerate and thus can affect the reactivity of the functional groups contained on the ring. The focus of this research project is the evaluation of the stereochemical selectivity that results from a nucleophilic, and stereochemically labile carbon-magnesium bond contained on a menthol-derived six-membered ring. The potential applications of this research could be in the production of chiral menthol-derived catalysts for the production of new enantioenriched medicines.

# Extracorporeal Cardiopulmonary Resuscitation for Cardiac Arrest-Predicting Survival

Wade Mather (University of Utah)
*Faculty Mentor: Joseph Tonna*

Background >300,000 people have a cardiac arrest outside of the hospital (OHCA) each year. Although many of these victims receive cardiopulmonary resuscitation (CPR) and advanced cardiac life support (ACLS), fewer than 10% survive. Among patients with OHCA, many are due to an acute occlusion of a coronary artery supplying blood flow to the heart. Cardiac catheterization with angioplasty can open this vessel, but is generally not possible for patients undergoing CPR. Veno-arterial extracorporeal membrane oxygenation (VA-ECMO), has been used for patients in cardiopulmonary arrest (called eCPR), and has demonstrated improved outcomes compared to conventional ACLS for some patient populations. VA-ECMO supplants function of the heart and lung, restoring blood pressure and flow, perfusion to vital tissues, and affords the patient physiological stability necessary for transport to the catheterization laboratory for treatment of the occlusion. Our research addresses questions related to the efficacy and appropriate application of VA ECMO for OHCA: (1) Does the selective use eCPR decrease the mortality rate of cardiac arrest victims treated in our hospital? (2) What key parameters must be taken into consideration to determine patients that are appropriate for the treatment? Methods To aid in predicting survival of cardiac arrest victims, recent research has generated a variety of scores-values calculated from key demographic, situational, and physiological information about the arresting patient. Past and prospective VA-ECMO patient data at our institution will be used both to (1) assess the effectiveness of scores developed by other organizations, and (2) determine from our subset of patients additional key parameters that will aid in predicting survival of future patients for whom the treatment is being considered. Additionally, data analysis regarding all outcomes will confirm or refute the appropriateness of the treatment. Summary Delineating proper procedure and considerations prior to ECMO initiation will result in better outcomes of those patients treated with ECMO therapy and lend support to those considering or seeking to improve its use in their institutions.

# An in depth review of the phytochemistry and ethnopharmacology of Tridax procumbens

Heather Mathison (Utah Valley University); Samantha Beck (Utah Valley University); Toma Todorov
*Faculty Mentor: Olga Kopp*

Originating in Southeast and East Asia, Africa, and South America, Tridax procumbens is part of the Asteraceae family and has great ethnobotanical potential. It is a perennial plant with inflorescence capitulum that results in abundant production of seeds, making it a noxious weed if not controlled. The purpose of this research was to analyze and report the literature available about T. procumbens, exploring its phytochemical properties and biological activity. T. procumbens produces secondary metabolites that have been reported to have a variety of medicinal uses such as: anti-anemic, anti-inflammatory, anesthetic, pain relief, antimicrobial, antioxidant, anticancer, and immunomodulating properties. Different methods of extraction were compiled to show the wide range of various T. procumbens extracts in a variety of biochemical research. This paper shows that T. procumbens should be further explored for the potential of its secondary metabolites as a medicine or preventative treatment, making it a promising ethnobotanical resource.

# Satisfaction in Decision Making Among Children

Jade McCombs (Dixie State University)
*Faculty Mentor: John Pugliese*

Abstract When the number of options increase, satisfaction in one's choice decreases. Research has found that too many choices creates confusion and choice deferment. Decision making skills appear during childhood and get more complex as an individual ages. Younger children use fewer dimensions when making decisions. The ability to process the cost of trade-offs develops through the early preschool years (Paxton, 1995). Preschoolers can only adapt to this concept when the trade-off cues are engaging, relatively very clear, and straightforward. Knowing that you can change a choice that was made, or that you cannot change it may have an impact on a child's decision (Davidson & Hudson, 1988). Therefore, the purpose of this study was to test whether children are more satisfied with their choices when their choice involves changeable (reversible) outcomes or if they are more satisfied with choices that involve unchangeable (irreversible) outcomes. I expected to find that children would be more satisfied when the outcome is unchangeable compared to when the outcome is changeable. To test this hypothesis, an experiment was conducted at the Dixie State University with 28 preschoolers ages three or four. Participants were recruited from the on-campus daycare center at Dixie State University. Children were placed in either a changeable or an unchangeable condition and were asked to indicate how satisfied they were with toys they had chosen to play with. The results supported the hypothesis that preschool age children are more satisfied with unchangeable outcomes. Future research could evaluate whether or not these results are applicable in other situations such as foods or activities. Keywords: children, satisfaction, decision making, choices, changeable and unchangeable outcomes

# Simulation Increases Understanding of Poverty in Future Healthcare Providers

Mike McNeil, SN (Brigham Young University); Gaye Ray, RN, MSN, FNP-C (College of Nursing Brigham Young University)
*Faculty Mentor: Gaye Ray*

Purpose: The purpose of this pilot study is to examine medical sociology students' poverty simulation reflection papers to (1) determine the overall effect of participation on future medical professionals, (2) identify new understandings or thoughts experienced as a result of participation, and (3) determine if students feel this experience will influence future careers. Ultimately, we will compare the reflection themes from medical sociology students to those from nursing student poverty simulation reflections. Background: 14 medical sociology students participated together with 52 nursing students in a Poverty Simulation as part of their respective course work. During the 3.5-hour simulation, students assume identities and life situations similar to those in poverty, being assigned as members of diversely configured low-income families. Students develop strategies to meet their basic needs, including food, shelter, living expenses, school, employment, and healthcare. Activities occur in the face of realistic life challenges, including emergencies, illnesses, and job loss. Faculty volunteer to staff simulated community sites where students interact to attempt to meet their family's needs. Sites include grocery stores, banks, employment and social services, schools, police stations, childcare, and healthcare facilities. Facilitators debrief students after the simulation. Brief Description of Project: Qualitative data from student reflection papers from (medical sociology students as one group and nursing students as a second group) are being analyzed during regularly-held meetings. The first-cycle coding process identifies and labels segments with topical similarities. Using focused coding, a second-cycle coding process will be used to relate categories and to identify elements most salient in the initial coding process. Finally, the coding results will identify themes from recurrent ideas and similar experiences expressed in the reflections within each group. Results: Competed analysis of the nursing students' papers demonstrates simulation provokes (1) deep emotions fostering empathy towards the impoverished, (2) enhances understanding of poverty, (3) dispels previously held stereotypes, and (4) serves to influence their future careers. First-cycle coding of medical sociology students' reflection papers demonstrates similar simulation outcomes. Final analysis and comparison will be completed in January 2016. Conclusions: Simulation has extraordinary influence on nursing students, and thus far our analysis suggests the same for medical sociology students, in helping them understand health disparities, access barriers, and social determinants of health. Participation in poverty simulations will influence future medical careers and motivate future medical professionals to become involved with poverty reduction efforts, eradication of health disparities, and reduce barriers to healthcare for this vulnerable population.

# Parameletus columbiae Genome (Ephemeroptera)

Dustin Miller (Utah Valley University); T. Heath Ogden (Utah Valley University)
*Faculty Mentor: T. Heath Ogden*

Next generation sequencing allows investigators to quickly generate enormous amounts of data for further analysis. The Ogden Lab at Utah Valley University is initiating efforts to sequence the genomes of mayflies. Parameletus columbiae is a species of mayfly found in Silver Lake, a protected wetland environment, near Brighton, Utah. It is an important species in the evolutionary tree of mayflies. Next generation sequence data can help elucidate the relationships and evolution of these insects. Furthermore, characterization of this species in this uniquely preserved wetland is important. Objective: A future goal is to utilize the next generation sequence data to elucidate the relationships and evolution of mayfly insects. Other future projects may include creating hybridization probes and genome annotation. Methods: DNA was extracted from P. columbiae and sent to Idaho State University for next generation sequencing. The sequence data was generated using the illumina MiSeq machine. The resulting genomic data - millions of short sequence reads - was then analyzed with a variety of software programs (Geneious, Sequencher, PoPoolation, etc.) in order to check the quality of the sequence reads, trim the sequences, and generate contigs of overlapping homologous sequences. Conclusion: Many different lines of investigation can be carried out with genomic data. Analysis of the genomic data provides a profile of the genes (and much more) found in mayfly species. We will initially be using this data to identify more than 500 loci that will be sequenced across other mayfly taxa in order to better understand the relationships of these insects. This project is a great opportunity to help characterize the genetic diversity for P. columbiae from a protected Utah wetland and contribute to genomic research being done at UVU.

# The ESCRT Pathway

Matthew Miller (University of Utah); Dawn Wenzel
*Faculty Mentor: Dawn Wenzel*

The ESCRT pathway is group of proteins that can be recruited to different cellular membranes to catalyze membrane fission. The ESCRT-III (endosomal complexes required for transports) proteins play crucial roles in controlling abscission (the process of separating daughter cells in cytokinesis) and other cellular processes that involve membrane fission. ESCRT-III proteins provide the constricting force required for membrane fission, and they recruit essential cofactors, which contain Microtubule Interacting and Trafficking (MIT) domains. We don't know if all of these cofactors interact with the ESCRT-III pathway. We know that a lot of these proteins have enzymatic functions, but we are not sure about their specific roles in the ESCRT pathway. We used a biochemical technique called fluorescence polarization to measure binding constants (KDs) for MIM and MIT interactions, and therefore identify which MIT domains bind with which of the 12 ESCRT-III proteins. We performed binding experiments with MIT domains to identify the full cohort of ESCRT-III binding partners. By comparing KDs for different binding partners, we will also learn rules governing the specificity of MIT domain and MIM interactions. This could help us predict ESCRT-III binding partners for new MIT domains. On a broader scale, we hope to be able to use this knowledge to learn, which MIT domain containing proteins function within the ESCRT pathway to perform the abscission step of cytokinesis or facilitate virus budding from the cell and which proteins serve other purposes. The MIT domain containing proteins are of particular importance because these proteins play a crucial role in cellular regulation and problems with the pathway have been linked to HIV and cancer. We hope that as we study the ESCRT-III pathway that we can learn more about these diseases and hopefully begin to speculate on new methods to treat these diseases.

# Art, Ecology and the Politics of Land Use

Alison Mitchell (University of Utah)
*Faculty Mentor: Alison Denyer & Paul Monty Paret*

Since the 1990's the politics of land use have become a major theme in contemporary art and theory, and as we acknowledge an age in which humans have shaped the earth's surface on a planetary scale artworks have set out to address the enduring impact of humanity's land use practices. In Utah alone, economic, political and social conflicts have determined the irradiation of land and the severe pollution of our air quality. This exhibition serves to investigate the landscape as a cultural artifact by illustrating the conflicts, histories, and ideologies that have structured our everyday lives. The goal of this creative work is to offer a viable questioning of land use practices in the Salt Lake Valley and the sustainability of these practices by coupling objective documentation in photographs, maps, and site visits with subjective creations in painting, drawing, photography, mapping and installation.

# INCORPORATING HEALTH LITERACY PRINCIPLES INTO COMMUNITY HEALTH NURSING

Melissa Mossar (University of Utah); Mikaelyn Kooyman (University of Utah)
*Faculty Mentor: Sara Hart*

Health literacy is a driver of access to health care. The average reading level for the adult population in the United States is fifth grade. Most medical documents are written at a high school reading level, or higher. This results in many patients who cannot understand important health documents, including medication instructions, diagnostic information, and discharge instructions. For example, 86% of Americans cannot understand the "Rights and Responsibilities" section of the Medicaid Handbook, while 78% misinterpret warnings on prescription labels. As more patients become health literate, medical costs will decrease and education of the population will be more effective. In the Salt Lake Valley, patients at the Maliheh and Hope Clinics have unique barriers in accessing health care. These community clinics serve predominantly uninsured and underserved populations, including immigrant populations, patients with chronic conditions, and patients that fall into the Medicaid expansion gap. Examination of the current health education materials at each of these clinics found that the Principles of Health Literacy guidelines established by the National Action Plan to Improve Health Literacy were not being used to communicate important health information (United States Department of Health and Human Services, 2010). After determining the deficits in current health documents at the clinics, health pamphlets were redesigned to make them more effective in delivering information to patients. The newly created health documents follow health literacy standards. These standards include readable fonts, bulleted sections, white-space, vocabulary that does not exceed a fifth grade reading level, clear explanations of medical terminology, and a standardized format for all documents. By creating health literate documents, patients have better access to information regarding their current health issues and the management of their individual health and health care. Providing health education at a level that underserved populations can understand enables them to better manage their own care and care provided in hospitals and clinics. In the United States over $100 billion is spent on avoidable medical costs. By improving access to health literate documents, these unnecessary costs can be greatly reduced. Access to health literate documents can help to reduce these unnecessary costs, increase preventive care and improve health outcomes.

# RECRUITMENT OF ETHNICALLY DIVERSE POPULATIONS IN DIABETES RESEARCH

Melissa Mossar (University of Utah)
*Faculty Mentor: Nancy Allen*

The incidence of Type 2 Diabetes Mellitus (T2DM) is higher in ethnically diverse populations. These individuals are at risk for poor health outcomes due to T2DM. Despite the high percentage of T2DM, ethnically diverse populations are underrepresented in diabetes research. My study team has been recruiting for a study titled, "Self-efficacy Scale for Diabetes Dietary Behavior: Development and Psychometric Evaluation." The goal of this study is to develop a self-efficacy measure for following a diabetes meal plan in individuals (including, ethnically diverse populations) with T2DM. This study is ongoing and we are actively recruiting participants. Research needs to include ethnically diverse populations since they are affected the most and have unique problems with adapting to lifestyle changes and potential causes of poor health outcomes. Barriers to the recruitment of ethnically diverse populations have become evident throughout this phase of the study and have limited the ability to recruit participants from these populations. This has shifted the focus of the study towards accessing and recruiting ethnically diverse populations. A review of the available literature was conducted to inform our recruitment practices, finding that the best practices include advertisement, the reduction of barriers in enrollment, accessing participants in their own communities, and creating documents in multiple languages. Approaches to diabetes research in ethnically diverse populations can eliminate barriers for participants, be culturally sensitive, and be enhanced using a variety of methods. The clear discrepancy between ethnic groups and the incidence of diabetes calls for more concentrated observation and study on ethnically diverse populations in diabetes research.

# Microbial Diversity of Culinary Salts

Galen Muske (Westminster College); Dr Bonnie Baxter (Westminster College)
*Faculty Mentor: Bonnie Baxter*

Extremophiles are exceptional microorganisms that live on this planet in extraordinarily harsh environments. One such extremophiles are Halophiles, salt-loving microorganisms that can survive in extreme salinity levels, and have been to found to survive inside salt crystals. We were curious is about the potential diversity of halophiles surviving in salts harvested from around the world. For this experiment various culinary salts were suspended in a 23 % NaCl growth media broth and allowed to grow for 4 weeks. Afterwards, the individual strains were isolated on 23 % NaCl growth media agar plates. The colonies observed were visually diverse in color and margins. Individual colonies were grown in broth and DNA was extracted. PCR and sequencing were utilized to compare the 16S rRNA gene in each species of bacteria or archaea. We will present data on the microbial diversity of the salts that did have media cultures. These salts come from 1) salt pearls from Lake Assal Djibouti, Africa; 2) Gray sea salt from France, Europe; 3) sea salt from Bali, Indonesia; and 4) salt collected from the lake bed of Great Salt Lake, Utah.

# Treating Dual Diagnosis by Addressing the Genesis of Self-Sabotage

Anastasia Najarian (University of Utah)
*Faculty Mentor: Jeanine Stefanucci*

Self-sabotage has seemed an illusive mystery since the dawn of the human experience. Dark communication is the genesis of self-sabotage to which no one is immune. The societal implications of self-sabotage are widespread, impact every aspect of life and begin at birth. Children who have a strong sense of attachment to their caregivers have a higher tendency to develop a healthier sense of self-worth. When looking at this destructive cycle, an early foundation of self-esteem plays a major role. (Hazan & Shaver, 1987, p. 44). Caregivers who are emotionally abusive, verbally or paralinguistically can create long-term self-sabotaging behavior. Emotional abuse is a form of interpersonal communication that affects intrapersonal communication and is proven to be more damaging and longer lasting than any other form of abuse (Harper & Arias, 2004). Intrapersonal communication is established early in life and is influenced by the nature of the attachments and potential dark communication to which we have been subjected. (Anderson & Guerrero, 1998, p. 70). Perceptions of self and the world shape beliefs, which in turn affects the family system. This research addresses the core factors that are the impetus of self-sabotaging behavior which may contribute to dual diagnosis. These include the nature of attachment to primary caregivers, the intrapersonal communication that results from that attachment, the cyclical pattern of self-sabotage, and the resulting dynamics of family systems. The Sabotage Cycle is a treatment model implemented and created by the student author to analyze three questions: 1. Is dark family communication as it relates to self-sabotage a primary factor that contributes to dual diagnosis? 2. Can core beliefs that drive perception of self and others be changed to curb self-sabotaging behavior and mental health issues in dual diagnosis clients? 3. Does implementation of a changed core belief reduce self-sabotage and recidivism long-term?

# Classification of Bacteriophage Isolated from the Great Salt Lake using Electron Microscopy

Brent D. Nelson (Weber State University)
*Faculty Mentor: Matthew J. Domek*

Bacteriophage lyse bacteria and play crucial role in the recycling of nutrients in a halophilic environment such as the Great Salt Lake (GSL). A previous study showed that the bacteriophage CW02, isolated from the GSL, was a dsDNA bacteriophage with icosahedral head and a short non-contractile tail and belonged to the bacteriophage family podoviridae. CW02 was also shown to share a conservative protein fold in a capsid protein originally identified in bacteriophage HK97. Very few bacteriophage isolated from the GSL have been assigned within the bacteriophage classification scheme. In this study we attempt to classify recently isolated bacteriophage from the GSL based on morphology using transmission electron microscopy (TEM) and molecular techniques. Bacteriophage were isolated from water and soil in or near the GSL. Bacterial lysate containing bacteriophage were centrifuged and filtered to remove bacterial debris. The sample was concentrated using 100,000 molecular weight cut-off filters. Samples were further purified by CsCl density gradient ultracentrifugation. Six bacteriophages have been imaged using TEM. TEM has shown all bacteriophage infecting Salinivibrio costocola bacterium SA-39 to be icosahedral with no detectable tail while bacteriophage infecting Salinivibrio costicola bacterium SA-40 having a circular head with a long tail. This suggests that the structure and shape of the bacteriophage capsid play an important role in the specificity of the bacteriophage to host. Based on shapes found using TEM, the bacteriophage infecting SA-39 likely belongs to the Podoviridae group while bacteriophage infecting SA-40 possibly belong to either long-tailed bacteriophage families Myoviridae or Siphoviridae. At least one bacteriophage will be selected for further characterization using cryogenic electron microscopy. Such imaging will enable us to determine the 3D characterization of the capsid, more accurately place the bacteriophage into its proper grouping, and evaluate the bacteriophage for the presence of the HK97 protein fold.

# Learning Gains from Recurring "Teach and Question" Homework Assignment in an Introductory Biology Course for Non-Majors: Utilizing Reciprocal Peer Tutoring Outside of Class

Nicholas Nelson (Brigham Young University); Patrick Stockdale (Brigham Young University); Michelle Baek (Brigham Young University); Katie Fairholm (Brigham Young University); Clint Morris (Brigham Young University); Nicole Rice (Brigham Young University); Shannon Rose (Brigham Young University); Kurt Williams (Brigham Young University); Elizabeth G. Bailey (Brigham Young University)
*Faculty Mentor: Elizabeth G. Bailey*

One of the biggest challenges in large introductory biology courses is allowing students to receive one on-one interaction with the professor. Large student to instructor ratios encourage a reversion back to traditional lecture-style classes, which are less interactive and promote surface understanding rather than deep student learning. One way to achieve one-on-one interaction is to have students interact with their peers during class. This has been shown to increase performance on higher-level test items. Reciprocal peer tutoring is a more involved interaction between students that requires peers to alternate filling the roles of "teacher" and "student" in discussing course material. Theoretically, advantages for peer tutoring include the verbalization and questioning of information and the scaffolded exploration of material through social and cognitive interaction. Studies on reciprocal peer tutoring vary in their execution of the exercise, but most require elaborate planning and take up valuable class time to implement. In this study, we tested the efficacy of a simple homework assignment in a general biology course called a TQ (Teach and Question), which required self-selected pairs of students to engage in reciprocal peer tutoring weekly. One student acts as the "teacher" and teaches that week's concepts to the "questioner" while the "questioner" asks questions to probe their understanding and help them think more deeply about the material; afterward, the students switch roles and repeat the exercise with new questions. A control section of the same course completed a substitute assignment, which required students to simply review course material on their own rather than engaging in a discussion with another student, while all other pedagogical methods were identical to the TQ section. The section that utilized the TQ assignments outperformed the control section on ten short midterms throughout the semester and the final exam (average of 6.3% higher). This difference in performance was significant even when student reasoning scores were added as a covariate, with a medium effect size (Mixed ANCOVA; TQ treatment: $p = 0.01$, $\eta p 2 = 0.07$; no significant interaction; $n = 43$ per section). The greatest benefits of the TQ were seen for students with lower-level reasoning skills. Audio recordings of student TQ sessions were also coded for length, types of questions asked and answered, and the tendency of students to give up when faced with more difficult questions. These results were used to investigate any correlation between TQ quality and student performance. We will report these more nuanced results as well as student attitudinal data.

# Use of methyl and monomethyl viologens as catalysts in the production of hydrogen from glucose for the use in hydrogen fuel cells and as electron carriers in glucose fuel cells

Joseph Nguyen (Brigham Young University); Gerald Watt (Brigham Young University); John Harb (Brigham Young University); Randy S. Lewis (Brigham Young University)
*Faculty Mentor: Gerald Watt*

Development of clean, renewable energy has led to an efficient hydrogen fuel cell; however, the efficiency of synthesizing hydrogen (H2) is less than ideal. A typical H2 fuel cell operates at 0.5-0.8V at a full-rated load. The electrolysis of water in standard conditions requires a theoretical minimum of 1.23V. Current water electrolysers require higher voltages for the reaction to proceed, which reduces the efficiency of generating H2 for electricity through electrolysis. Commercial production of H2 is also accomplished by Steam Methane Reforming (SMR) which requires high temperatures 700-1100 °C. Both processes require large amounts of energy, which reduces the efficiency of H2 production for the generation of electricity for fuel cells. We report that the use of methyl and monomethyl viologens (MV and MMV) as catalysts in the breakdown of the abundant fuel, glucose (GLC), with a platinum (Pt) cocatalyst yields comparable hydrogen to electrolysis of water and SMR. Additionally, reduced MMV can be used as an electron carrier in a GLC fuel cell. MV is a simple and inexpensive organic molecule that catalyzes the oxidation of GLC and other carbohydrates producing carbonate and water at pH 10-12 near room temperature. MV removes an electron (e-) and becomes reduced (MVr). This e- is readily transferred to oxygen forming water just as in a H2 fuel cell. Unlike H2, MVr has a low electron potential, resulting in a poor electron carrier for a fuel cell; however, MVr in a reaction with Pt and excess acid will yield H2 molecules and MV. MV also catalyzes oxidation of GLC and captures e- becoming reduced (MVr). MVr has a higher electron potential, making it more feasible for use in fuel cells. These catalysts, MV and MMV will allow for cost effective synthesis of hydrogen as well as new, stable electron carriers in GLC fuel cell applications.

# The Effect of Students' Emotional Maturity on Their Perception of Test Question Fairness: an fMRI Study

Sarah Nguyen (Brigham Young University); Jonathan Wisco PhD (BYU, University of Utah)
*Faculty Mentor: Jonathan Wisco PhD*

A university student's satisfaction with a course and their motivation to do well is largely determined by the student's perception of fairness in grading procedures and expectation of grade outcome. Similarly, professors feel greater personal and career satisfaction when they experience fair student-instructor interactions and reasonable expectations of grades. Even though it seems that students and instructors want the same thing, there is a strong disconnect between the two parties. Many students feel that they are being assessed unfairly in their coursework while professors are simultaneously trying to create fair tests. This project will determine if this disconnect is caused by a lack of emotional maturity (EQ) on the student's part. We hypothesize that a student's EQ has a direct affect on his or her ability to answer specific question formats a professor may use to assess their performance in a course. If this is the case, the perceived disconnect could be attenuated by using appropriate specific question types to more fairly assess students at all EQ levels. Students (males and females, ages 18-30) from Brigham Young University will be recruited via e-mail (already approved by the IRB). Students from three different colleges, specifically the colleges of Humanities, Life Sciences and Fine Arts and Communications, will be sub-grouped by year in school (specifically freshman/sophomore and junior/senior). Each participant will take the Mayor-Salovey-Caruso Emotional Intelligence Test (MSCEIT), a validated emotional maturity test often used in psychological research, and select multiple-choice passages of the ACT reading comprehension, English and science sections of the test. The ACT test provides a validated, fair test. After completing both instruments, students will participate in a focus group to discuss the multiple-choice questions and whether or not the students' thought the questions were fair. The ACT questions have been vetted previously by their governing organization. Upon completing the focus group, participants can volunteer to participate in the second half of the study that involves an fMRI scan. During the scan, participants will be shown questions from the multiple-choice test that they have already taken and discussed and will be asked to determine if the question is fair or unfair using a push button box. We will view brain activation, specifically looking in the prefrontal cortex and limbic systems. Opinions regarding fairness of the assessment questions and brain activation will be compared with the subject's emotional maturity score to determine if there is a correlation between student emotional maturity and their views on test question fairness. We will also examine which regions of the brain are activated when determining fairness. There has been very little research in determining brain activation so this research will hopefully lead to further research concerning fairness.

# How's your Aspen: Stomatal Differences in Western Aspen and Linkage to Drought Tolerance

Brianne Palmer (Utah State University)
*Faculty Mentor: Karen Mock*

Aspen (Populus tremuloides) is the most widely distributed broadleaf forest tree in North America. However, aspen are declining rapidly in areas of the Intermountain West. Aspen in this area are prone to experiencing limited moisture and high temperatures. An important aspect of plant physiology when dealing with these stressors is stomatal function. Stomata control the rate of photosynthesis, therefore, the size and frequency of the stomata is likely to influence the survival of the species in this environment. An unusual feature of aspen is the high frequency of triploidy in the southern portion of its range. Stomatal size and density differences between cytotypes have not been assessed in aspen. The purpose of this study is to evaluate the differences in stomatal length and density between diploid and triploid aspen in Utah. If stomatal differences are pronounced between cytotypes, this could be the basis of a rapid field-based test to distinguish cytotypes without laboratory analyses. To test this, I collected leaves from independent clones in Logan Canyon and Fish Lake National Forest in the summers of 2013, 2014, and 2015. Through flow cytometry I determined the ploidy of the trees. Using cellulose acetate impressions of the underside of the leaves I measured the stomatal size and frequency. Based on my preliminary analyses, there is a difference in stomatal size and density between clones rather than between cytotypes. Understanding the complexities of the different aspen ploidy levels is essential in future forest management and prediction future vegetation changes in a changing climate.

# Creating a Monster: Attachment Theory in Mary Shelley's Frankenstein

Sam Passey (Dixie State University); Lyndsey Craig (Dixie State University); Christine Fiscer (Dixie State University); RonJai Staton (Dixie State University); Jeremy Scritchfield (Dixie State University); Barbara Balbas (Dixie State University); Amy Harmon (Dixie State University); Craig Demke (Dixie State University); Joey Jergins (Dixie State University); Tim Bywater (Dixie State University); Dannelle Larsen Rife (Dixie State University)
*Faculty Mentor: Dannelle Larsen Rife*

Research in human development suggests relationships are vital for physiological and emotional well-being across the lifespan. Attachment theory is foundational for relationships and is intrinsic in human nature as it is represented through words of novelists. Attachments are developed within the first year of life based on caregivers' appropriate, contingent, and prompt responses to the infant's cues. Avoidant attachment develops when the infant receives minimal responses to his or her cues. John Bowlby proposed the attachment relationship between the infant and parent creates an internal working model (IWM). This IWM sets the foundation of all subsequent close relationships throughout the lifespan. Individuals who have avoidant attachment representations are dismissive of, and lack security in relationships. Living in a time where women were marginalized, segregated, and many lacked formal education, Mary Shelley effectively produced a popular work of fiction in the early 1800s. Shelley was a keen observer of relationships long before Attachment Theory was developed in the 1960s. Psychobiographical methods were used to examine Shelley's Frankenstein as a case study of Attachment Theory. Results suggest Shelley's Frankenstein depicts basic components of attachment theory, and "Frankenstein," the monster character, exemplifies avoidant attachment. Through his dismissive and proximity seeking behaviors, the monster characterizes Bowlby's description of avoidant attachment. Lacking relationships during critical periods for development of empathy, the monster loses the ability to feel remorse. This critical examination of early British literature as a case study for Attachment Theory lends retrospective support for the understanding of human relationships.

# Management for Game Species can Positively Impact Reptiles and Amphibians in Artificial Wetlands

Kristopher Pederse (Utah State University); Rich Etchberger (Utah State University); Lianna Etchberger (Utah State University); Charles Hanifin (Utah State University)
*Faculty Mentor: Charles Hanifin*

Global declines in amphibian and reptiles have left many species in danger of extinction. These taxa are important components of terrestrial and aquatic ecosystems and, in some cases, substantial effort has been expended to maintain populations of these animals. In Utah, multiple reptile and amphibian species are listed as species of concern and the focus of regulatory protection. Anthropogenic causes for species declines include invasive species, pollution, and habitat loss. Habitat loss can be mitigated by manipulation of preexisting habitat. For example, the creation of artificial wetlands generates new habitats in which species may live and breed. This study sought to identify the herpetological species occurring within the Pariette Wetlands (UT), an artificial wetlands created to mitigate habitat loss associated with upstream dams on the Green River. These wetlands are, by federal statute, explicitly managed for waterfowl, but are also home to non-avian species. Our single-year survey (2015) coupled with data from an earlier study (1993) documented six species of lizard, four species of snake, and three species of amphibian within the Pariette Area of Critical Environmental Concern. We identified larval and juvenile specimens of both reptiles and amphibians indicating breeding populations of these taxa. Amphibian and reptiles were common suggesting large and likely stable populations of identified taxa. Our results provide a baseline for ongoing surveys in the Pariette Wetlands and suggest that artificial wetlands, even when managed for game or sport species such as waterfowl, can have a positive impact on populations of amphibians and reptiles.

# MAGNAMWAR - Mono-Associated Gnotobiotic Animal Meta-Genome Wide Association R Package

Corinne Penrod (Brigham Young University)
*Faculty Mentor: John Chaston*

Host-associated bacteria affect critical traits within an organism such as, metabolic, nutritional, vascular, hepatic, respiratory, immunological, neurobiological, and endocrine function, as well as feeding patterns and social interactions. We previously developed a technique for predicting bacterial genes that influence animal phenotypes based on metagenome-wide association of gnotobiotic monoassociated animals. This approach identified bacterial genes that influence animal phenotypes based on animal traits scored when several dozen genome-sequenced bacterial species were individually associated with the host. This software package programmed in the R language streamlines the steps in this computational pipeline. The software requires as inputs a phenotypic data set and amino-acid fasta files for the monoassociated bacterial species. Sequentially, the package then parses protein sequences that were clustered using OrthoMCL software (from web or local executables) into presence and absence groups (clusters of orthologous groups (COGs)), testing each COG for a significant association with a phenotypic trait. Additional features of the software package include the ability to export graphics useful in visually communicating results, such as Manhattan and quantile-quantile (QQ) plots, phylogenetic trees attached to phenotypic data, and COG presence-absence pattern bar charts; and to export key data including COG allele frequencies, presence-absence patterns, and effect size. By using the analysis from this package, researchers will be able to target predicted genes for validation by mutant analysis, leading to greater understanding of the genetic basis for host-microbe interactions.

# Effects of Latter Day Saint missions on weight

Danni Petersen (Utah Valley University); Ryan Roberts (Utah Valley University)
*Faculty Mentor: Christopher Anderson*

Despite the 85,000 Latter Day Saint (LDS) missionaries around the world, little research has explored the effects of a mission on the individual. Many individuals associated with the LDS church believe missions often pose changes in weight. However, these weight changes are only backed by anecdotal evidence. The purpose of our research was to assess the fluctuation in weight among LDS missionaries. A survey was administered to Utah Valley University students to evaluate body composition and lifestyle. A sample of 270 college students participated in the hallways at Utah Valley University. All participants, including those who served a mission within the last 5 years (n=101, the mission sample), completed a weight management questionnaire and health history form. Anthropometric measurements were recorded (weight and circumference values of the neck, hip, and abdominal area). SPSS data analysis software assessed average weight gain/loss overall compared to average weight gain/loss over a two-year trajectory in a sample of participants who did not serve a mission in the last 5 years (non-mission sample). We also analyzed mission sample values based on the area of the world members of the mission sample served. We proposed the results would display significant differences in weight before and after the mission. Compared to pre-mission weights, we predicted lower post-mission weights in those who served Central American, South American, and Asian countries. We predicted higher post-mission weights in those who served in the United States, Europe, Russia, and Australia. The data did not display significant differences in weight gain based off of the region of the world where the missionaries served. Interestingly, comparisons of weight change between the mission sample and the non-mission sample yielded no significant differences. The "mission weight myth", which denotes changes in weight relative to individuals who do not serve missions, was not supported by our data. The myth could be attributed to heuristic bias. Peers have not seen missionaries for two years, any change in weight is likely to seem more drastic and leave a greater impression than weight changes observed incrementally over the span of two years.

# Combined targeted inhibition of STAT3 and the epigenetic regulator LSD1 alters proliferation and molecular phenotype in glioblastoma tumor stem-like cells

John Stuart Peterson (University of Utah); Jingye Yang (Huntsman Cancer Institute); Amiee Maxwell (Huntsman Cancer Institute); Adam Cohen (Huntsman Cancer Institute, Department of Internal Medicine); Sunil Sharma (Huntsman Cancer Institute); Howard Colman (Huntsman Cancer Institute; Division of Medical Oncology, Department of Neurosurgery)
*Faculty Mentor: Howard Colman*

In glioblastoma (GBM), an aggressive form of brain cancer, different subtypes exist with variable prognoses and responses to treatment. A phenotypic transition in GBM has been described in which better-prognosis proneural (PRO) tumors transform to a more aggressive mesenchymal (MES) phenotype. This shift has been linked to specific transcription and signaling pathways including STAT3, LSD1 and to epigenetic alterations in the histone proteins H3K4me3, H3K9me3, H3Kac and H3K27me3. Our results indicate that decrease in the level H3K4me3 is associated with MES transition in GBM, suggesting a role for epigenetic alterations in this process. Furthermore, pharmacologic of the epigenetic effects of LSD1 and inhibition of STAT3 signaling, have additive or synergistic effects on epigenetic alterations. These findings indicate potential therapeutic strategies to inhibit MES transition and sensitize GBM cells to current therapies by targeting both the transcription machinery, specifically STAT3, and the methylation of lysine 4 of histone 3 via LSD1.

# Efficacy of autologous fibrin glue in adult stem cell adherence to decellularized porcine scaffold

Donald Pfeifer III (Brigham Young University)
*Faculty Mentor: Alonzo Cook*

Xenotransplantation and tissue engineering are at the forefront of innovative research attempting to solve the organ donor shortage. According to the World Health Organization, cardiovascular disease is the number one cause of death worldwide. Unfortunately, the number of heart donors has reached a plateau despite an increasing number of potential recipients. Finding an alternative to human organ donation is vital and has the ability to save thousands of lives each year. Our research team has optimized the process of decellularizing porcine cardiac tissue in hopes of producing extracellular matrix (ECM) viable for human transplantation. Additionally, we have successfully recellularized cardiac ECM through the differentiation of iPSCs into cardiomyocytes. The long-term implications of this research involve whole organ transplantation that is the exact genetic match of the recipient through the use of autologous iPSCs. The transplant recipient would not require immunosuppressants, and the risk of organ rejection would be nominal. While the implications of this research are paradigm shifting, several issues remain before whole organ cardiac tissue engineering can be viable. One of the essential remaining problems is developing a method to reintroduce the correct cells on the proper ECM surface. Given the numerous cell types that make up the heart, using iPSCs would simplify this problem by allowing the cells to propagate into their natural arrangement. Unfortunately, the ECM does not possess the correct receptor sites for stem cell adhesion (Collagen-I), hence we can only effectively differentiate cells on histological samples where gravity does not move the cells from their proper location. This project intends to study the effect that different viscosities of fibrin glue will have on the growth and adherence of iPSC's on a 3-dimensional matrix. Fibrin glue is created by combining human platelet-poor plasma with a coagulation factor, in this case a thrombin solution. We will experiment with several different concentrations of platelet-poor plasma and thrombin, resulting in different adherence and growth characteristics for iPSCs on the ECM. We will compare which of the concentrations are best for the health and stability of the cells. As a control, we will compare cell adhesion against Vitronectin™ (Thermo Fisher Scientific®, Waltham, MA) as well as unaltered ECM. We will measure our results by comparing the total area covered by the cells. We will also stain the iPSCs with a fluorescent dye and test how thoroughly the cells have penetrated into the ECM. If data supports our hypothesis it may enable iPSC recellularization on a 3D protein scaffold. Successfully engineering a fibrin glue that will allow for iPSC adhesion to a 3-dimensional matrix will be a major contribution to the ultimate goal of developing an effective therapy for ischemic heart disease.

# Macaque Monkey V2 Thick Stripes Receive V1 Input from Layer 2/3 Blob/Interblob Borders

Anny Pham (University of Utah); Jeffrey Thomas Yarch ; Frederick Federer ; Alessandra Angelucci
*Faculty Mentor: Alessandra Angelucci*

Visual perception is a complicated process that begins when photoreceptors in the eye detect light. This information is sent to primary visual cortex (V1) in the occipital lobe of the brain. V1 consists of multiple layers. Across these layers different compartments can be found by staining for the cytochrome oxidase enzyme (CO). CO 'blob' areas process color information, while CO 'interblob' areas process object form information. V1 projects information to distinct 'stripe' compartments in the adjacent area V2 (thick, thin, and pale stripes). A recently proposed model of V1-to-V2 projections in macaque monkey suggests that thin stripes receive V1 inputs from blob columns, and thick and pale stripes receive input from interblob columns. However, new evidence from marmoset studies suggests that thick stripes specifically receive information from a unique area in V1, the blob/interblob border region. This new model has not been extensively studied in macaques, the closest model system to human vision, and therefore may be specific to marmosets. The objective of this study is to determine if macaque V2 thick stripes receive V1 input from blob/interblob borders in layer 2/3 of V1. Optical imaging will be used in vivo to identify V2 stripes. A modified rabies-GFP tracer will be injected into a thick stripe and will travel back to V1 neurons. After perfusion, brains will be sectioned, processed using histological methods, and mounted onto slides for use with light microscopy. Every third section will be reacted for CO to reveal blob and interblob compartments. Single sections containing labeled V1 somas will be aligned to an adjacent CO-stained section using blood vessel profiles. The distance of each soma to the nearest blob border will be measured to determine if the cell is in a blob, border, or interblob region. Thus far, data from macaque is in line with marmoset studies and shows somas biased toward the blob border. However, further data is needed. Results from this study are meaningful because it has previously been thought that cells in V1 that project to V2 were either in blobs or interblobs. Data from this study show that there is a distinct population of cells located on the border between these two regions. These neurons are unique because they are able to receive and integrate information going to both blobs and interblobs. Thus, while V2 thin stripes receive strictly blob information and pale stripes receive interblob information, thick stripes receive a unique integration of these two types of information. This finding will help to understand how different functions associated with each stripe type emerge in V2.

# The Best of Both Habits: John Stuart Mill, William Wordsworth, and the Power of Poetry

Nathan Porter (University of Utah)
*Faculty Mentor: Elijah Millgram*

John Stuart Mill was an important Utilitarian philosopher and an influential social reformer in nineteenth-century Britain. He was groomed from his earliest years to lead the British Utilitarian party, receiving a comprehensive and rigorous education. At the age of twenty, however, something quite unexpected happened: he suddenly lost all capacity for emotion. He remained in this state of misery for months, attempting a number of remedies, none of which availed. None, that is, until he discovered the writings of William Wordsworth, to which he attributed his recovery from the crisis. Mill believed that his breakdown was the result of his habitual tendency to analyze arguments and break down bad ones. He thought that he had destroyed his emotional associations, which, having been formed unnaturally by the use of reward and punishment, were more susceptible to the destructive influence of analysis. He felt he was in a hopeless state, for he could not avoid his irrevocably inculcated habit of analysis, and he therefore had no prospect of recovering his emotions. How did Wordsworth help him out of this slump? I argue here that Mill's interpretation of Wordsworth taught him that analysis is an absolutely necessary and beneficial capacity of human beings, but it requires a complementary habit to prevent it from wreaking havoc on the mind. This habit, according to Mill, is contemplation. I argue that reading Wordsworth showed him that by contemplating the conclusions reached by analysis, it is possible to generate emotions about them. (As a contemporary illustration, think of a physicist who meditates on the beauty of her mathematical models). Thus, through Wordsworth, Mill learned that by uniting the head and the heart through a proper balance of analysis and contemplation, he could keep the best and avoid the worst of both habits. Key to my argument are a number of sources that are rarely reviewed by Mill scholars, such as Wordsworth's Preface to Lyrical Ballads and a transcript of a debate in which Mill participated during his crisis. Also employed are sources that generally receive insufficient attention, such as Mill's notes to the Analysis of the Phenomena of the Human Mind and his essays on ancient philosophy.

# Guided Wave Environmental Compensation with Big Data Sets

Ben Posch (University of Utah); Joel Harley (University of Utah)
*Faculty Mentor: Joel Harley*

Ben A. Posch and Joel B. Harley Department of Electrical and Computer Engineering, University of Utah, Salt Lake City, 84112 In the last twenty years the U.S. has experienced 10,846 incidents from pipeline damage that led to 371 fatalities and 1398 injuries in addition to six billion dollars in property damage [1]. Structural health monitoring systems that can continuously monitor pipelines over time have the potential to reduce these statistics. Yet environmental conditions (e.g. temperature) challenge structural health monitoring systems because they can have a far greater effect on signal propagation than damage in a structure. While there has been some success to reduce the effects of environmental conditions [2], the most effective approaches (based on principal component analysis [3]) rely on computationally expensive algorithms that do not scale well with big data sets containing years of data. In this presentation we present a system for reducing the computational complexity of processing large ultrasonic guided wave structural health monitoring data sets. Specifically we integrate a computationally efficient approximation for principal component analysis into a structural health monitoring system. Our approach is based on a rank-revealing QR decomposition that performs a stochastic rank-k approximation of our raw data matrix [4, 5], which could contain years of measurements. As a proof of concept, we performed a 1000 trial Monte Carlo analysis on a synthetic data matrix with dimensions of 8000x100. Each matrix was created from random data and represents, 100 time-domain guided wave measurements with 8000 time samples over potentially multiple years of data collection. Damage was added at a random time for each trial. To assess our approach we computed the average computational cost, the average amount of time required to compute principal component analysis with the approximate rank-k data matrix, and the average detection accuracy, the percentage of trials for which the correct time of damage was detected. Our results are shown in Figure 1. Figure 1 shows that we can achieve high detection accuracy and low computational cost with 100 measurements. Reducing the matrix rank to 80 decreases the computational cost by approximately 28% while the accuracy only decreases by approximately 2%. In our presentation, we will further demonstrate these results for a large, realistic simulated guided wave data set. Figure 1: Monte Carlo Analysis for data of size (8000 by 100) [1] United States Department of Transportation Pipeline & Hazardous Materials Safety Administration, "PHMSA: Stakeholder Communications," 2013. [Online]. Available: http://primis.phmsa.dot.gov/comm/PipelineBasics.htm. [2] O. Putkis, R. P. Dalton, and A. J. Croxford, "The influence of temperature variations on ultrasonic guided waves in anisotropic CFRP plates," Ultrasonics, vol. 60, pp. 109-116, Jul. 2015. [3] C. Liu, J. B. Harley, M. Bergés, D. W. Greve, and I. J. Oppenheim, "Robust ultrasonic damage detection under complex environmental conditions using singular value decomposition," Ultrasonics, vol. 58, pp. 75-86, Apr. 2015. [4] Gunnar Martinsson, "Randomized methods for computing the Singular Value Decomposition of very large matrices," in The Workshop on Algorithms for Modern Massive Data Sets, 2012. [5] N. Halko, P.-G. Martinsson, and J. A. Tropp, "Finding structure with randomness: Probabilistic algorithms for constructing approximate matrix decompositions," SIAM Rev., vol. 53, no. 2, pp. 217-288, 2011.

# What Does the Fos Say?

Jason Ray (Brigham Young University); Kyle Kener (Brigham Young University); Ben Bitner (Brigham Young University); Brent Wright (Brigham Young University); Matthew Ballard (Brigham Young University); Larry Moss (Duke University)
*Faculty Mentor: Jeffery Tessem*

Type 1 and Type 2 Diabetes result in loss of functional β-cell mass. Increasing functional beta-cell mass could cure diabetes through pancreatic islet transplants or by strengthening endogenous cells. We and other groups have shown that Nkx6.1 increases functional beta-cell mass by increasing proliferation, glucose stimulated insulin secretion (GSIS), and cell survival. Proliferation is enhanced through the genes Nr4a1 and Nr4a3 (1), and GSIS and cell survival are increased through the gene VGF (2). We have shown that Nkx6.1 induces expression of c-Fos in beta-cells. c-Fos is sufficient to induce proliferation, GSIS, and cell survival. Furthermore, we have shown that c-Fos induces Nr4a1, Nr4a3, and VGF, demonstrating that it links Nkx6.1 to these downstream targets. Finally, we have shown that c-Fos knockdown in beta-cells inhibits Nkx6.1-mediated proliferation and GSIS. These data show that c-Fos is critical for maintaining and increasing functional beta-cell mass.

# Assessment of exercise-stimulated tissue oxygenation in calf muscle with functional MRI

Andy Renz (University of Utah); Jeff L. Zhang (University of Utah)
*Faculty Mentor: Jeff L. Zhang*

Assessment of exercise-stimulated tissue oxygenation in calf muscle with functional MRI Andy Renz1, Jeff L. Zhang2 1. Department of Physics; 2. Department of Radiology, University of Utah Introduction: In western countries, atherosclerosis has high prevalence and is associated with high morbidity and mortality. As a form of atherosclerosis, peripheral arterial disease (PAD) affects approximately 8 million American adults, including 12-20% of Americans over 60 years. Currently, PAD can be accurately diagnosed with MR or CT angiography to detect narrowing of the peripheral arteries. However, to properly manage PAD, reliable techniques to assess function of the calf muscle are required. In this project, we tested the feasibility of blood oxygen level dependent (BOLD) MRI in assessing tissue oxygenation of calf muscle during exercise recovery, and proposed a method for interpreting tissue oxygenation dynamics in exercise recovery. Methods and Materials: Twenty-four subjects (17 healthy and 7 PAD) were recruited in this IRB-approved study. Each subject underwent MRI scan at a 3T clinical scanner (Trio, Siemens). In the scanner, the subject performed plantar flexions using an MRI-compatible apparatus for 3 min at 1 Hz. The load of the apparatus was adjustable. For this study, we used 2 loads, 4 lbs and 8 lbs. After exercise stopped, BOLD imaging started immediately with a multiple-gradient-echo sequence: matrix: 64x64, resolution 2.5x2.5x10 mm, TEs 22.0 and 57.2 ms, TR 96 ms, temporal resolution 8 sec. In post-processing, regions of interest (ROI) were manually drawn around individual calf muscles to obtain the averaged signals within the ROI. Using an exponential function, R2* for each muscle was estimated from the BOLD signals. High R2* correspond to low tissue oxygenation. For each muscle, we obtain a R2*-vs-time curve (time interval 8 sec). R2* dynamics in exercise recovery: We propose to quantify the R2*-vs-time curve for each muscle group using a model-based approach. The model involves parameters such as exercise R2*, minimum R2*, time to minimum R2*, and R2* recovery time. For each parameter, we compared between the healthy subjects and the PAD patients, and between exercise of different loads (4 and 8 lbs) using t test ($p < .05$). Results: Analysis of R2* data showed significant differences between healthy and PAD subjects as well as subjects tested with different loads. The R2* recovery time was significant only in the load comparisons. Conclusion: BOLD data analysis is a viable technique for examining tissue oxygenation in the calf. The parameters examined can indicate whether a subject has PAD. Potentially, BOLD could be used to diagnose patients of PAD in the future. Additionally, BOLD analysis quantifies oxygen concentration changes after varying exercise loads.

# Nerve Growth Factor Increases Repair of Crushed Peripheral Nerves

Mark Rigby (Brigham Young University); Ryan Wood (Brigham Young University); Matt Landeen (Brigham Young University); Tyler Brown (Brigham Young University); Jonathan Jacobs (Brigham Young University); Austin Thompson (Brigham Young University); Keaton Karlinsey (Brigham Young University); Trent Taylor (Brigham Young University); Stephen Wong (Brigham Young University); Stephen Wirthlin (Brigham Young University); Scott Steffensen (Brigham Young University); Alonzo Cook (Brigham Young University)
*Faculty Mentor: Alonzo Cook*

One of the responses following a traumatic injury to the peripheral nervous system (PNS) is an increased expression of nerve growth factor receptors (NGFR), which helps to stimulate the regeneration of the nerve. In a normal, healthy PNS, NGFRs are rarely found. Following damage to the nerve, NGFRs can be found in high levels around the damaged area. In this study, traumatic injury to the sciatic nerve of rats was performed in order to study the effects of regeneration after a local application of nerve growth factor (NGF). Both a physical crush model and a focal demyelination model were used to simulate the nerve injury. In the crush model, the effect of a crushed extracellular matrix on degeneration and subsequent regeneration was studied. In the focal demyelination model, the effects of local demyelination with an intact extracellular matrix on degeneration and regeneration were investigated. In two additional experimental groups, an intraneural injection of NGF into the damaged sciatic nerve one week after the crush or lysophosphatidylcholine (LPC) injection at the damaged site were performed. The nerves were examined both qualitatively using SEM and immunohistochemistry, and quantitatively using transdermal local electrophysiology. It was found that the addition of NGF increased the rate of nerve regeneration in both models. The models were then combined and LPC was applied to crushed nerves. Adding NGF to LPC-crush nerves regenerated faster than crushed nerves only receiving NGF. Faster regeneration can be achieved through a LPC-NGF combination.

# The Impact of Farm Ties on Climate Change

Jordan Risley (Utah State University); Douglas Jackson-Smith (Utah State University); Melissa Haeffner (Utah State University)
*Faculty Mentor: Douglas Jackson-Smith*

Although there is evidence that farmers feel differently about climate change than the general public, there have been few studies of whether urban people who have family ties to agriculture have a similar perspective. This presentation will report results of a recent public survey to explore whether urban people with farm ties express lower levels of concern for climate change. While they themselves are not farmers, the hypothesis is that their social and cultural connections to farmers lead them to share views on this important issue that are similar to the agricultural community. The presentation will present data from a major public survey that was conducted between September 2014 and November 2015 from almost 7,000 randomly sampled adults shopping at 28 grocery stores in Utah. The survey was implemented by trained students from 6 different universities who randomly approached adults entering each grocery store and invited them to complete a short self-administered questionnaire on an iPad. Stores were selected to represent diverse geographic and sociodemographic areas across urban areas in the state. To capture a good cross-section of the shopping public at each location, field staff collected data in 1-3 hour blocks over several days of the week and at different times of day. Overall, we achieved a 40.6% response rate. This analysis uses bivariate statistical methods to test whether there is a statistically significant connection between having farm ties and a personal concern level for climate change. Results indicate that people with farm ties are significantly less likely to be concerned with climate change. This suggests that social networks between farmers, who make up less than 1 percent of the nation's population, and their relatives, who represent almost a quarter of our urban population in Utah, are important to understanding patterns of beliefs and concerns about climate change.

# Epilobium angustifolium's Endophytic Fungi and their Biologically Active Secondary Metabolites

Michael Roberts (Brigham Young University)
*Faculty Mentor: Bradley Geary*

Project Purpose To conduct an ecological study of the endophytes of Epilobium angustifolium to identify novel microbes producing antifungal secondary metabolites, specifically oenothein B and β amyrin. Project Importance Infections due to fungal pathogens have become increasingly prevalent [1], resulting in a greater need for more diverse antiproliferative compounds. However, their production faces restriction by the limited availability of the plant source and the difficulty and cost of extraction of each compound. In response, recent studies by Castillo, Li, and Strobel [2] have shown that endophytes existing within these same plants produce identical compounds. The use of endophytic compound production has proven to be less expensive and more efficient than traditional methods of production [2]. Despite this claim, little research has been conducted about endophytes and the possible applications of their secondary metabolites in the fields of medicine as well as agriculture. Project Question Traditionally, Epilobium angustifolium has been used to treat fungal infections and recent studies have proven its antifungal potential [1 and 4]. Research shows that it produces oenothein B and β amyrin [4 and 5], which are proven antifungal compounds [4, 5, and 6]. We hypothesize that endophytes within Epilobium angustifolium produce identical anti-fungal compounds. Methodology First, plant samples of Epilobium angustifolium, which is native to Utah, will be collected from an area near Alta, Utah. Roots, stems, and leaves will be surface sterilized to eliminate all nonendophytic organisms, and placed on water agar. Next, each endophytic isolate will be cultured on agar until they have grown about 15-20 mm. Each of these isolates will undergo bio-assays against various known fungi to determine the presence of antifungal secondary metabolites. Once bioactivity is confirmed for an isolate, it will be grown in broth to accumulate endophytic product in liquid media. A secondary bioassay will be conducted to confirm bioactivity. Next, the liquid media will undergo a series of extraction methods [3,7] before being filtered, lyophilized, and subsequently screened using mass spectrometry to determine the presence of oenothein B and β amyrin synthesized by endophytes. NMR will be used to examine the structure of these compounds, and HPLC will be used to quantify their production. Each of the endophytes producing bioactive compounds will be analyzed and characterized morphologically by light microscopy and SEM. The genus and species of endophytes exhibiting antifungal activity will be determined by DNA sequencing. Conclusion We anticipate discovery of unidentified species of endophytic fungi producing antimicrobial secondary metabolites. Our research of the endophytic activity in Epilobium angustifolium will contribute to the general understanding of the applications of previously underused biologically active compounds.

# Accuracy in Predicting Personal BMI Category Among College Students

Ryan Roberts (Utah Valley University); Christopher Anderson (Utah Valley University); Ron Hammond (Utah Valley University); Christina Tsoi (Utah Valley University)
*Faculty Mentor: Chris Anderson*

Background: Previous research shows that approximately 20%-33% of Americans inaccurately predict their BMI category. This can be a problem since perception contributes to one's perceived need to integrate healthy behaviors into their lifestyle, and also reduction of one's positive self-image. Purpose: The purposes of this study were to first, determine the frequency of college students who inaccurately predicted their BMI category and second, what factors may contribute to that accuracy, if any. This is important as little research has been done in both the accuracy and the factors that contribute to it. Method: 272 college students agreed to answer questions in a survey format, then have anthropometric measurements taken. The survey included items such as specific lifestyle behaviors, recent weight history and self-perception. After, we took weight and body circumference measurements and compared them to the participants' perception of self. Results: 38% of our sample inaccurately predicted their BMI category. Many of the inaccurate perceivers were in the normal and overweight category. Discussion: Clinicians would benefit from the awareness of what can skew one's self-perception, and make necessary adjustments. Educators can benefit from this study by making lesson plan changes to decrease the risk of students misperceiving their weight status.

# Professional vs. Nonprofessional Exercise Prescriptions and Injury Correlation

Mercedes Robinson (University of Utah)
*Faculty Mentor: Charlie Hicks-Little*

Purpose: Risk of injury, when participating in an exercise program, is always present; however when the exercise program is poorly designed or not designed for the individual, the risk of injury increases significantly. Poorly designed exercise programs stem from individuals seeking advice for exercise from nonprofessional sources that are unable to personalize programs and monitor the individual throughout their exercise progression. Currently, the literature exploring the connection between nonprofessional exercise advice and the rate of injury sustained from exercising is scarce. The purpose of this study was to see if there is a correlation between exercise advice coming from professional (professionally certified trainers and research based media) or nonprofessional (non-research based media and uncertified nonprofessionals) sources and injuries that are sustained from exercising. Hypothesis: Higher rates of injury will result for individuals who seek out exercise advice from nonprofessional sources. Methods: Exercisers (n=280) from the University of Utah Student Life Center were surveyed. Data analysis was performed to analyze the correlations between injuries sustained in a gym setting, and nonprofessional or professional exercise advice received prior to injury, as well as descriptive statistics regarding the population. Results: Population consisted of 55 freshmen, 40 sophomores, 50 juniors, 73 seniors, 41 graduate students, 5 post-graduate students, and 11 staff or faculty members, with average age being 21.1+/-8.2 years, and the average BMI 24.2+/-3.8. Participants sought out advice from the following sources: 39.6% friends or other exercisers (8.2% injury rate), 31.7% self-programmed exercise (11.8% injury rate), 16.4% media sources (7.1% injury rate), and 12.3% from personal trainers (4.7% injury rate). Discussion: The participants that self-programmed exercise in a nonprofessional manner also observed the highest injury rate. In all groups, the majority of the participants considered their exercise advice to be professional, but upon examining the sources, very few were found to be professional in nature. In order to reduce injuries sustained by students participating in campus recreation programs, these facilities should make more professional exercise resources available for student use.

# The Tomb of Francois de Halluin

Avenel Rolfsen (Westminster College); Ashleigh Albrechtsen (Westminster College)
*Faculty Mentor: Mary Jane Chase*

The tomb of François de Halluin, destroyed in 1751, has no extant image, only a written description. Halluin was Bishop of Amiens from 1503-1538. The cathedral canons saw Halluin as an arrogant, unfriendly pleasure seeker, imposed on the chapter by the king. He died in 1538 in a hunting accident and was buried without spectacle at the Abbey of Gard (where he was also abbot). This left his tomb in Amiens empty. Church dignitaries saw it as outlandish and over the top. It stood at the same height or higher than the shrines of the founding saints of Amiens! The Tomb was destroyed when the Cathedral was being redesigned to a more baroque style. This research project attempts to recreate this early French Renaissance tomb as accurately as possible from the description of historian Georges Durand. Other research included information about the artistic style of the time and images of contemporary tombs. The result is the first image of the tomb of François de Halluin. The image is an important contribution to art history and to the history of Amiens Cathedral.

# People on the Periphery: The Situation of Jewish Women in North Africa During World War II

Avenel Rolfsen (Westminster College)
*Faculty Mentor: Gary Marquardt*

The Holocaust has become one of the quintessential discussions of history, and as such, much has been written about the catastrophic inhuman actions the Nazis levied against the Jews of Europe during World War II (WWII). The vast majority of this writing focuses on the plight of European Jews during this time. What many people are inclined to forget is that the Jews of Europe were not the only ones affected by this ghastly event. Undoubtedly, the Jews of Europe received the short end of the stick; however, WWII also affected North African Jews. In Tunisia, Algeria and Morocco, the racial laws of Vichy France greatly affected the lives of 400,000 Jews. Literature discussing the Jewish situation within North Africa is minimal and limited in scope. Most of this literature is marginalized within larger surveys of North African history. Very little focuses on North African Jews during WWII; even less focuses on the lives of Jewish women in the region at this time. In contrast to Jewish women's protests and rebellion in Vichy France, North Africa's Jewish women are strangely quiet. This paper examines Jewish women's lives in North Africa during WWII and argues that they actively mitigated their oppression in many ways. Jewish women created makeshift schools, took new jobs, engaged in prostitution, and protested food rations and the absences of their husbands and sons. This research fills a large gap in North African and women's history; it also adds to the expanding literature on holocaust and women's history. It presents a world in which Jews and women are not simply oppressed but one in which they work to diminish their oppression.

# Energy from Thin Air: Compressed Air Power Harvesting Systems

Zachary Sadler (Brigham Young University)
*Faculty Mentor: Matthew Jones*

Energy is a vital resource within the world we live that drives economy and industry. Resources such as crude oil, coal, solar and wind are used to create power the world requires. The demand for power is insatiable. While additional sources for energy are constantly being researched, an additional means of meeting the world's demands is to harvest power from thermal energy. Thermal energy is an inevitable byproduct of virtually all naturally occurring and anthropogenic processes. When this thermal energy is created, it is transferred as heat to the atmosphere. Because the energy becomes largely unavailable for further use, it is often referred to as waste heat. One widespread example of waste heat generation is when air is compressed. Air compressors can be found in factories, shops and garages over the entire world. Compressed air is very inefficient with 60-90% of the power input being rejected as heat through the intercooler [1]. It is expected that a sizable amount of this energy can be reclaimed with a direct energy conversion device (e.g. a thermoelectric generator). This electricity can be used to increase the efficiency of the device or power other processes in the shop or commercial space-lowering power costs. The potential for power harvesting can be seen in Figure 1, which shows a preliminary analysis of the potential temperature differences between the entrance and exit temperatures using a polytropic process as a function of exit pressure. The goal of the research is to create a model to predict the power generation of from the thermoelectric generator. The heat transfer will be optimized analytically using the heat sinks and the thermal resistances (hot-side, cold-side and bypass resistances). By adjusting the thermal resistances, the optimum heat transfer rate through the direct energy conversion device will maximize the energy generated by the device. The thermal resistance of the bypass thermal path will be optimized so that almost all of the heat transfer will occur across the direct energy conversion device [2]. In addition, the thermal resistances will be optimized so that the temperature across the heat engine will be maintained according to the ratio: $T_{L,TEG}/T_{H,TEG} = \sqrt{T_L/T_H}$ , which will maximize the power created by the device [2]. The 2nd law efficiency of the thermoelectric generator is also considered in the optimization. System analysis and optimization will be based on the concept of exergy, or available energy. Preliminary calculations shown in Figure 1 illustrate that there is a sizable amount of thermal energy that is created by compressing air. Reclaiming waste heat offers an increased efficiency of an otherwise inefficient process. With the model created by this research, consumers and professionals will be able to implement these systems on a wide scale. Sources [1] Cerci, Y., Cengel, Y. A., and Turner, R. H., 1995, "Reducing the Cost of Compressed Air in Industrial Facilities," Thermodynamics and the design, analysis, and the improvement of energy systems, pp. 175-186. [2] Lee, H., 2010, Thermal Design, John Wiley & Sons, Inc.

# P2P Offloading in Mobile Networks using SDN

Ryan Saunders (University of Utah); Junguk Cho (University of Utah); Arijit Banerjee (University of Utah); Frederico Rocha (University of Utah); Jacobus Van der Merwe (University of Utah)
*Faculty Mentor: Jacobus Van der Merwe*

The peer-to-peer (P2P) architecture and the mobile network architecture have conflicting designs. P2P can take advantage of peers being in close proximity to decrease latency. However, the mobile network is hierarchical as routing is directed through centralized gateways. Because of network state needed to established connections in the mobile network, user equipment's traffic needs to travel up the hierarchy before being redirected back down to a nearby peering device. The inherent delay and the additional network state strip P2P applications of their primary advantages over client-server applications. We have developed a Software Defined Networking (SDN) architecture to offload and redirect peering traffic before reaching the core of the mobile network. Our implementation allows for any P2P communication independent of the mobile provider and the peering application. We have evaluated our design and demonstrate that there is a decrease in latency by approximately a factor of two with our method compared to a standard P2P procedure between smartphones in the same mobile network.

# Identifying the genes that contribute to hybrid male sterility in D. pseudoobscura

Alysha Scheeler (University of Utah)
*Faculty Mentor: Nitin Phadnis*

Speciation, the process of one species dividing into two separate species, gives rise to the breadth of biological diversity on earth. This division often works through the evolution of reproductive isolating barriers, such as hybrid sterility, between two previously interbreeding populations. Despite decades of work, we know very little about the fundamentals of this system: what are the genes involved and what are their molecular mechanisms? Here, I present my genetic and molecular work to identify a gene contributing to hybrid sterility between two closely related subspecies of Drosophila pseudoobscura, Bogota and USA. When USA males are crossed to Bogota females, the male progeny are sterile. The fertility of these hybrids can be completely rescued by swapping USA material with Bogota material at the X22 locus on the X chromosome, suggesting the presence of a large effect and essential gene in this genetic region. I aim to map this gene contained in the X22 locus that is contributing to hybrid male sterility through a genetic technique called recombination mapping. This technique narrows the size of the USA introgressed region around the X22 locus, reducing the size of our candidate gene region. Using multiple independently derived introgressions, I will identify the common USA genetic material that rescues sterility in hybrid males, and repeat this process until I have a region that contains approximately ten candidate genes. So far, I have narrowed the common USA region to approximately 30 genes. Once I have narrowed my list of candidate genes to ten, I will use a genome editing approach to replace these genes in Bogota with the equivalent USA allele and test for rescue of hybrid male sterility. By identifying the genes that contribute to hybrid male sterility in Drosophila pseudoobscura, we will lay a foundation to better understand what genes and processes create early species barriers between hybrids.

# Effects of frequent marital communication and decision-making on psychological outcomes: A study of older adults

Jordan Sgro (Brigham Young University); Wendy C. Birmingham (Brigham Young University); Maren Voss (University of Utah); Jerry Bounsanga (University of Utah); Man Hung (University of Utah)

*Faculty Mentor: Wendy C. Birmingham*

Objectives: Marriage has been consistently associated with better physical and mental health. However, specific mechanisms regarding the impact of marriage on health are less well understood, especially for psychological well-being. Frequent partner communication and joint decision-making may lead to better mental health outcomes. Five factors of psychological wellbeing have been conceptualized and include (1) autonomy, (2) environmental mastery, (3) personal growth, (4) positive relation with others, (5) purpose of life, and (6) self-acceptance. The purpose of this study was to identify potential pathways between marital status and pyschological well-being through effective couple communication and decsion making. Methods: Using data obtained from the Midlife in the US (MIDUS) study, we examined psychological well-being, couple communication, and decision making. Descriptive statistics were conducted using SPSS. To test our proposed model, confirmatory factor analysis and structural equation modeling were conducted using MPlus. Six observed variables represented psychological well-being. Results: Our sample included 3,487 adults, mostly male (51.8%), educated (63%), and White (94.2%) with an average age of 53.69 years old. More frequent couple communication ($\beta$ = - 0.097 with 95% CI = - 0.145, -0.048; $p < 0.001$) and more frequent couple joint decision-making ($\beta$ = 0.219 with 95% CI = 0.172, 0.267; $p < 0.001$) had a significant positive influence on wellbeing. Overall, there was also a good model fit to the data (RMSEA=0.089; CFI=0.955; SRMR=0.030) Conclusions: Our findings show that better mental health is associated with marriage. A possible pathway to increase psychological well-being in older individuals include frequent couple communication as well as joint decision-making.

# May Swenson: The Development of a Legacy

Marissa Shirley (Utah State University)
*Faculty Mentor: Joyce Kinkead*

While many cities all over the United States of America are home to important scientific and literary figures, few can claim to give those figures adequate remembrance. May Swenson was born (1913) and grew up in Logan, Utah, and was graduated from Utah State University (1934). She then went on to a widely recognized as a highly influential twentieth century poet, earning recognition as Chancellor of the Academy of American Poets, a recipient of the MacArthur Foundation Fellowship, and a getting her portrait hung in the National Gallery, among other accomplishments, but many Logan residents remain unaware of her legacy. The May Swenson Poetry Path was created to educate local residents about their very own nationally recognized literary figure. The Path serves as a physical representation of the learning and research process of important local figures. Visitors to and residents of Logan now have the opportunity to follow a path outlined in a locally available brochure, reading and learning about May Swenson along the way. The Path outlines spots all over the Logan, Utah area where mementos to May Swenson, such as poems or plaques, are on display. The researcher, Marissa Shirley, engaged in study of Swenson's life and works to develop a succinct product. Additionally, she worked with the Literary Estate, the City of Logan, and the University to achieve approvals. A printing of hundreds of brochures have introduced Swenson to visitors, and their publication coincided with the naming of a City of Logan Poet Laureate. We hope that the May Swenson Poetry Path can and will be used as a model to honor, remember, and respect scholarly figures of any area and promote the awareness of a community's history.

# Effects of Spousal Attitudes on Own Exercise Behavior

Jordan Sgro (Brigham Young University); Emily Hartung (Brigham Young University); Wendy C. Birmingham (Brigham Young University); McKenzie Carlisle (University of Utah)
*Faculty Mentor: Wendy C. Birmingham*

Background: It is well known that one's own attitude often predicts one's own behavior, but does one's spouse's attitude predict one's own behavior? Performance of exercise may in part be socially-determined (e.g. you exercise if you have a buddy; you don't exercise because your spouse would rather watch TV together). We examined links between one's spouse's attitude towards exercise and one's own exercise behaviors. We also examined whether mere perception of spouse attitude predicts one's own behaviors. Method: As part of a larger study, we recruited 47 married couples. In each dyad, both partners rated their own, and their perception of their spouse's, attitude towards exercise, as well as their own self-reported weekly exercise behaviors. Results: One's own exercise attitude was associated with exercise duration ($p \leq 0.01$) and intensity ($p \leq 0.01$), but not exercise frequency ($p=0.2$). Spouse's actual exercise attitudes were not associated with one's own exercise duration ($p=0.8$) or intensity ($p=0.7$), but was associated with one's own frequency ($p \leq 0.01$). Perceptions of spouse attitudes was not associated with duration ($p=0.8$), intensity ($p=0.4$), or frequency ($p=0.2$). Conclusions: While one's own attitude predicted duration and intensity, it was spouses' actual attitudes (not merely perceptions) that predicted the frequency (# of days) of exercise. National guidelines recommend adults engage in moderate-intensity exercise at least 30 minutes/day, on 5+ days each week. The frequency of exercise may be more important for health than how long or intense the exercise session was, as people could be engaging in very long and strenuous exercise only 1 day or less each week, and miss out on the benefits that come from less intense (e.g. brisk walking) or shorter sessions on more days of the week. With spouse attitudes being more predictive of one's own frequency of exercise, if the goal is to get individuals more physically active in general, interventions targeting just one's own exercise attitudes and behavior may be less effective than a more dyadic approach.

# Relationship quality and body image: Can supportive spouses make a difference?

Jordan Sgro (Brigham Young University); Erin Kaseda (Brigham Young University); Adriane Cavallini (Brigham Young University); Kiley Ballew (University of Nevada, Las Vegas); Spencer Nielson (Brigham Young University); Kristen Ray (Brigham Young University); Chris Herron (Brigham Young University); Kyle Eversole (Brigham Young University); Katie Hyatt (Brigham Young University); Wendy C. Birmingham (Brigham Young University)
*Faculty Mentor: Wendy C. Birmingham*

Background: Previous research has examined eating disorders (EDs) in regards to marriage and intimate relationships. As well, marital conflict plays an important role in the development and continuation of EDs in married women. However, much of the literature focuses on women who are already diagnosed with ED while ignoring women who are exhibiting ED behaviors but have not been diagnosed with Bulimia Nervosa (BN), Anorexia Nervosa (AN) or Binge-Eating Disorder (BED) (e.g., sub-clinical). Sub-clinical symptoms of AN and BN are the most common forms of eating disorders and many individuals with sub-clinical AN eventually develop full syndrome AN. Method: In the present study, we examined the association between marital relationship quality (RQ) and ED symptoms in 24 sub-threshold married women ages 18-50. The average age was 30 with 95.8% of our sample being white. We used the Marital Adjustment Test (MAT) to measure relationship quality. We found that 76.2% of all of the women were not distressed in their relationship, indicating that most of their relationships were positive and supportive. Interviews were then conducted to ask more in depth questions about their relationships and their self-esteem and body image. Results: When asked the question: "How do you feel that romantic relationships influences the way a woman feels about her body image?", 95.8% of women expressed that romantic relationships do have an effect on a woman's self-esteem and body image. Furthermore, 91.7% of women reported that when they are feeling unhappy with their appearance, their spouses respond positively. Despite these responses, in the Body Assessment Questionnaire (BAQ), 83.3% of women responded to the question "When I see myself nude in the mirror, my reaction is..." with a non-positive word or phrase, such as "gross", "disappointment", "you look awful", "to look away", and "appalled". Conclusions/Significance: Our results demonstrate that there is a disconnect between women's perception of how a relationship theoretically should impact body image, and the reality of their own marital relationship and body image. Women claim that their husband's are supportive and that this helps their self-image, but contradict these statements as they self-report harsh and negative statements about their bodies in the written response question.

# Waste and Cost Reduction by Reprocessing Used Motor Oil into a Synthetic Diesel Fuel

Kevin Shurtleff (Utah Valley University); Ryan Bernal (Utah Valley University); Christian Fullmer (Utah Valley University); Mung Nam Ng (Utah Valley University); Kyle Sweetman (Utah Valley University)

*Faculty Mentor: Kevin Shurtleff*

Utah Valley University has an abundance of waste motor oil (WMO) from the airplanes, motor vehicles, and utility vehicles operated by the University. Currently, there is no well documented and accessible procedure for reprocessing the WMO into a useful fuel without expensive industrial equipment. The primary goal of this project, led by Professor Kevin Shurtleff and performed by undergraduate research students, is to repurpose the WMO into a-useful, synthetic diesel fuel with a cost-effective, scalable process we've developed. Since diesel fuel is a mixture of hydrocarbons, motor oil (a heavier hydrocarbon) can be diluted with lighter hydrocarbons to produce a synthetic diesel fuel that has comparable chemical and physical properties to diesel. The two main obstacles are getting the oil clean enough for re-use and determining the optimum ratio of motor oil to the other lighter hydrocarbons in the fuel mixture. We have tested fractional distillation and centrifuation of the WMO to remove impurities. Centrifugation combined with filtering is the most cost effective and efficient method. Distillation proved too difficult. We have prepared various mixtures of WMO with unleaded gasoline and waste aviation fuel to produce an efficient synthetic diesel fuel that we have tested in the diesel generator. The goal is to produce synthetic diesel fuel for use in the utility vehicles on campus. This means that every gallon of repurposed WMO eliminates disposal costs and saves the University the cost of a gallon of diesel fuel. In this paper, we will describe the equipment, processes, and results achieved on the project.

# Low-Cost, Balloon Lifted, Wind Powered, Air Compressor for Clean, Sustainable, Renewable Electricity Generation

Kevin Shurtleff (Utah Valley University); Vladyslav Boyko (Utah Valley University); Phillip Witt (Utah Valley University); Clayton Rawson (Utah Valley University)
*Faculty Mentor: Kevin Shurtleff*

The purpose of our project led by Dr. Kevin Shurtleff in the Chemistry Department at Utah Valley University and performed by undergraduate students is to create a viable and cost effective alternative form of electricity generation for isolated and underdeveloped communities. Cost is the most important consideration, since conventional generation methods are far too expensive for these communities to adopt. Our project focuses on ways to harness, store, and convert wind energy into electricity. We've learned that for the same cost of placing a 2kW wind generator on a 60 foot pole, we can get 8x the power production, if we lift the generator to 1,000 feet above the ground where the wind blows at approximately twice the velocity. So, a wind generator at 1,000 feet will produce electricity at 1/8th the cost of a ground based wind generator. In addition, wind at 1,000 feet is less variable (more constant). The problem is that a copper power cable large enough to carry the power to the ground from 1,000 feet would be too heavy to lift. To solve this, we decided to power an air compressor with the wind at 1,000 feet and transfer the energy to the ground as compressed air in a lightweight plastic tube. A key limitation of wind is that it is extremely variable, so we incorporated compressed air storage into the system. This enables us to stabilize power production despite the changes in the wind. The system is also set-up to incorporate other sources of compressed air, including solar, river, and wave powered air compressors. The overall generating system can be matched to fit the locally available resources. We are using large, very fragile, weather balloons to lift the air compressor to 1,000 feet. However, we've found that if we coat the weather balloons with additional layers of latex rubber, they become more robust and durable, while remaining inexpensive. We have also added a hang glider to the balloons for providing additional lift during high wind conditions at 1,000 feet. We plan to have the entire wind air compressor assembly in the air and collecting data by the end of the Fall 2015 semester.

# Low-cost, Low-impact, Portable, River Powered, Air Compressor for Clean, Sustainable, Renewable Electricity Generation

Kevin Shurtleff (Utah Valley University); Brennan Christensen (Utah Valley University); Jordan Lloyd (Utah Valley University); Joshoua Sieftke (Utah Valley University); Antonio Trevino (Utah Valley University)
*Faculty Mentor: Kevin Shurtleff*

The purpose of our project led by Dr. Kevin Shurtleff in the Chemistry Department at Utah Valley University and performed by undergraduate students is to create a viable and cost effective alternative form of electricity generation for isolated and underdeveloped communities, including mountain communities in Haiti. It is being performed in collaboration with Dr. Steve Emerman and Dr. Eddy Cadet in the Earth Science Department of UVU. Cost is the most important consideration, since conventional generation methods are far too expensive for these communities to adopt. Our objective is to design, build, and test a small hydroelectric power system that can be utilized in remote, underdeveloped, areas. We settled on a paddle wheel design. We took two small pontoons, placed a paddle wheel between them, mounted an air compressor on the pontoons and connected the paddle wheel to the air compressor with a v-belt pulley system. The floating system is moored to the banks of the river to hold it in place. The river water is channeled between the pontoons, spinning the paddle wheel, and turning the air compressor. This approach is not as efficient as a dam and penstock configuration, but it has much less impact on the river and it is portable, so it is easily moved to other locations. We have incorporated compressed air storage capabilities into the system for a more stable supply of electricity. The system is also setup to incorporate other sources of compressed air, including wind, solar, and wave powered air compressors. The overall generating system can be matched to fit the locally available resources. The low cost nature of our project makes it a perfect alternative for non-profit organizations like UVU. Upon successful completion of the project, we install the system on a river adjacent to a mountain village in Haiti and eventually in other underdeveloped communities around the world.

# Novel, Low-cost, Solar Thermal, Phase Change, Air Compressor for Clean, Sustainable, Renewable Electricity Generation

Kevin Shurtleff (Utah Valley University); Preston Eyre (Utah Valley University); Colin Manitoken (Utah Valley University)
*Faculty Mentor: Kevin Shurtleff*

The purpose of our project led by Dr. Kevin Shurtleff in the Chemistry Department at Utah Valley University and performed by undergraduate students is to create a viable and cost effective alternative form of electricity generation for isolated and underdeveloped communities. Cost is the most important consideration, since conventional generation methods are far too expensive for these communities to adopt. The work we are doing at Utah Valley University is novel. We have designed and built a two-stage, solar thermal, phase change, air compressor that uses heat from the sun to vaporize two working fluids in different stages that compress neoprene rubber tubes filled with air to achieve a total pressure of 120 psi. The solar collector measures four feet wide, eight feet long, and just less than ten feet tall. We are striving to make it as efficient as possible, so it will significantly reduce the cost of electricity while allowing communities to have a reliable source of power. However, solar power has one key limitation in that it does not generate power at night. This is why we have incorporated compressed air storage capabilities, which can provide electricity during off hours. The system is also set-up to incorporate other sources of compressed air, including wind, river, and wave powered air compressors. The overall generating system can be matched to fit the locally available resources. The low cost nature of our project makes it a perfect alternative for non-profit organizations like UVU. We are in the construction phase of the project and hope to have test data and results by the end of the Fall 2015 semester.

# Peruvian Immigrant Paradox: Exploring differences in learning cultures and mathematics curriculum

Giulia Soto (University of Utah)
*Faculty Mentor: Susie Porter*

Math instruction for immigrant students often begins with the assumption that this student population lacks math knowledge and skills necessary for academic success in the United States. Immigrant students in the U.S. are often placed in lower lever math classes due to the misconception that it will help them acquire English language skills. This deficit view of Latino immigrant students disregards the immigrant paradox being that first generation immigrants have better educational outcomes than individuals born in the United States, despite their similar disadvantaged circumstances. This study seeks to understand the immigrant paradox through Peruvian immigrant youths' educational experiences by: 1) a comparison of Peruvian and United States math curriculum; and 2), interviews with Peruvian immigrants who attended school both in Peru and Utah. My research indicates that a large number of Peruvian immigrants in Utah have a vast knowledge of math skills and language learned in their home country, Peru, which helps students connect concepts and succeed in math courses in the U.S.

# Margin of Licensed Dog and Cat Populations and Adoptions from Animal Shelters in Utah Counties in 2013-2014

Marli Stevens (University of Utah)
*Faculty Mentor: None None*

Different counties and cities in Utah require dog licensing and cat licensing. Out of the 29 counties, 3 do not require licensing at any level. The licensing requirements can help track dog and cat populations in Utah and keep a record of the levels of dog and cat growth or decline overtime. If compared to animal shelter adoption numbers, these records can determine where these animals are coming from. If the population number is growing but the adoption numbers from shelters during the same time period do not meet that growth pattern, than it can be speculated that the majority of the animals are coming from pet stores, breeders, migration, or puppy/kitten mills. Especially in the rural areas and counties of Utah, these records can potentially determine whether there are puppy/kitten mills in business and investigations can be done to find whether these businesses are up to par in business and animal rights laws. Many pet owners do not license their pets even when required but licensing is the only way to get an exact number of pet dogs and cats living in an area. Using GIS, a thematic map of Utah has been made to create a visualization of the different counties in Utah that require licensing at which levels. Since not all of Utah is the same with licensing requirements and many counties do not have the tools to access the licensing numbers, it is very difficult to track the population numbers per year for dogs and cats. With this discovery, this research is to be used as an educational tool to better the understanding of licensing in Utah and its importance. The subject of dogs and cats as pets, where they come from, and what their lives entail is also an educational outcome of this research. Keywords: GIS, geography, population, dog, cat, Utah, puppy, kitten, mill, pets, shelter, adoption, map, education.

# A Real-World Investigation of the Attentional Capture Paradigm

Patrick Stewart (University of Utah)
*Faculty Mentor: Trafton Drew*

Current research in cognitive psychology has demonstrated that performance on a visual search task will degrade in the presence of an object that appears different than all the other objects (like a red apple amongst green apples); this effect is known as "attentional capture" and has been well documented in laboratory studies. However, thus far the effect has been confined to laboratory experiments with poor ecological validity (e.g., searching for T's amongst L's on a computer screen). In this study we hoped to determine if this effect can be replicated in a real-world scenario. We will equip subjects with eye-tracking glasses as they search for one unique object in a field of otherwise uniform objects. On some trials, one non-target object will be a different color than the others and we will measure the effect that this has on response times. Thus far, we have successfully created an analogous real world experimental scenario that emulates important aspects of the attentional capture paradigm. Soon, we will test our hypothesis that this effect will replicate in this more ecologically valid environment.

# UFOs in Post War America: An Alien Viewpoint of Utah

Christina Summers (Weber State University)
*Faculty Mentor: John Sillito*

A society's interpretation of "signs in the skies" reveals to historians how it perceived unexplained events within a particular era. As humanity entered the technological age of the 20th Century, a new explanation for unknown things in the skies surfaced. Such phenomena were dubbed "Unidentified Flying Objects," or UFOs. During World War II, UFOs were generally thought of as enemy spy technology. However, in Post War America, other explanations for strange things in the skies became prevalent. In my presentation, which is focused on Utah, I will consider how Post War Americans explained paranormal activities, specifically UFOs. Several case studies will be presented to show that the Post War Utah residents interpreted UFOs in four general ways: as enemy spy technology, aliens, hoaxes, or natural phenomena misinterpreted. The interpretation of UFOs as enemy spy technology demonstrated society's acknowledgement of the possible threat that technology posed to public safety. The interpretation of aliens not only showed America's advancement into the space age, but also revealed societal concerns with government ineptitude and conspiracy. Generally, aliens were interpreted as either god-like beings who came to earth to help and observe humanity, or devils who came to harm and destroy human civilization. UFO hoaxes displayed a segment of American society with a lack of scientific knowledge, as well as the need for notoriety and monetary gain. Natural phenomena misinterpreted as ghostly UFO tales provided community unity as well as entertainment. If the natural phenomena had a rational explanation, the UFO event was generally discarded as unimportant, which documented that society's acceptance of modern aerial technology and natural science. This paper is based on stories collected in Utah newspapers, the United States Air Force Blue-book files, and by Dr. Frank Salisbury, a botanist from Utah State University with a penchant for chasing UFOs.

# Anemia Research in Africa: Interpreting Unexpected Results

Kaeli Thomas (Brigham Young University); Karen de la Cruz (Brigham Young University)
*Faculty Mentor: Karen de la Cruz*

Title: Anemia Research in Africa: Interpreting Unexpected Results Purpose: To determine if iron supplementation or anti-parasitical treatment decreases anemia in kindergarteners in rural Ghana. Research hypotheses: 1) Administration of intermittent low-dose iron will increase hemoglobin levels in the subject population. 2) Administration of an anti-parasitical agent will increase hemoglobin levels in the subject population. 3) There will be no statistical difference in the hemoglobin levels of the two groups. Methodology: a. Setting and sample: Kindergarten students in primary schools of Eastern Region of Ghana. b. Design: Quasi-experimental quantitative design. It was culturally unacceptable to have a control group in this study. c. Instruments: Taylor medical grade electronic scale, stadiometer, Stanbio STATSite MHgb monitor. d. Procedures: All children enrolled in the study were assigned to one of two intervention groups: Fe supplementation only or anti-parasitic medication only. Group 1: Each child was given a single dose of an anti-parisitic medication, Benznidazole, at the beginning of the intervention and at 3 month intervals for the duration of the study. Group 2: Each child received 5 mg liquid iron supplement on each Monday, Wednesday and Friday that they attend school for the period of 6 months. Ghana utilizes a year round school model. Missed doses were not made up. The village Headman and community health clinic medical provider supervised the administration of Fe supplement and anti-parasitic to the children using the schedule provided by Primary investigator. e. Data analysis: A paper data collection instrument was created for this study. Each subject was assigned a unique and arbitrary ID to ensure accuracy for repeated testing. Data was entered from the paper data collection tool into an excel spreadsheet. Data entry was independently verified. Data were imported into SPSS version 21 for statistical analysis. Data were reviewed for missing values and outliers using descriptive statistics and appropriate figures. Variable change scores were examined for anomalous values and outliers before analysis. Relationships between predictors were examined using logistic regression. Findings: Pretest comparisons for height, weight and hemoglobin levels indicated no significant differences between intervention groups. Significant proportions of the study participants in both groups were anemic (hemoglobin levels < 11 g/dl) at pretest, 40.4% in the Fe supplement group and 30.1% in the anti-parasitic group. Conclusion: Both intervention groups showed similar hemoglobin levels at pretest and posttest. Neither intervention improved anemia status. We suspect these findings result from differences in diet due to seasonal changes. During the dry season, the food selection is different from the rainy season. We plan to continue the study to test this hypothesis.

# Analyzing Carbon Capture Ability of Solid Sorbents Using Thermogravimetric Analysis

Shalauna Thompson (University of Utah)
*Faculty Mentor: Kevin Whitty*

As climate change due to greenhouse gases becomes more of a globally recognized problem, efforts to reduce these gas emissions receive more attention each year. Carbon dioxide is a major greenhouse gas and the burning of fossil fuels contributes a significant amount to the atmospheric CO2. Recognizing the need to mitigate carbon dioxide emissions from fossil fuels, federal policies have been passed requiring states to reduce industrial greenhouse gas emissions. Current carbon capture methods are generally not cost effective, or are energy intensive, so they are not widely used industrially. It is therefore pertinent that cheaper and more efficient carbon capture technologies be explored as a way to reduce these emission levels. The purpose of this project is to research various solid sorbents as viable technologies in carbon dioxide sorption. The optimal conditions for adsorption and the reversibility of this process were determined for different sorbent designs and functionalization. Various morphologies of carbon nanotubes were provided by Dr. TC Shen (Utah State U). The nanotubes were then functionalized with carboxyl groups and amines by Dr. Kara Stowers (Brigham Young U). In addition, titanium nanotubes were provided by Dr. Swomitra Mohanty (U of U), and lithium fly ash provided by Dr. Aimaro Sanna (Heriot-Watt U). The mass of carbon dioxide adsorbed by the materials was determined using thermogravimetric analysis (TGA). TGA was also used to determine the optimal temperature for carbon capture, and multi-cycle experiments were done to examine the reversibility of the sorption process. Additional characterization of the materials using Brunauer, Emmett, and Teller Theory (BET) and scanning electron microscopy (SEM) was done. The significance of this project is evident because innovations in carbon capture technology can help industry meet emissions standards while simultaneously moderating the amount of greenhouse gases released.

# Stakeholder Perception of K-12 Education Mission Fulfillment: An evaluation of DaVinci Academy

Hayley Tomney (Weber State University); Pamela Payne (Weber State University)
*Faculty Mentor: Pamela Payne*

The purpose of this project is to partner with the DaVinci Academy of Science and the Arts to evaluate stakeholder perceptions of DaVinci's fulfillment of their mission. Stakeholders include: students, parents, facility, administrators, and the community. The DaVinci Academy of Science and the Arts is a title one school located in Northern Utah. The DaVinci Academy started out as a high school grades 9th-12th in fall of 2004 expanding to include elementary and middle school since that time. The school has a maximum capacity at 1100 students which they have reached. The board and administration of the DaVinci Academy came to partner with Weber State University Community Research Team to obtain an evaluation of their mission fulfillment. In this presentation we will share the instruments used to gather data from various stakeholders and the process by which this partnership has developed. This partnership is on-going with the goal of collecting survey data in spring of 2016 and fall of 2017. Data will be collected in a step wise process from parents, students, faculty, administration and community members. Following completion of the survey, we intend to have focus groups developed in order to understand the survey data at a deeper level so that it may be used to enhance the school. Thus far, we have agreed with school administration that the mission statement of the DaVinci Academy has three dimensions: 1) Student Outcomes; 2) Learning Environment; and 3) Public/Private Partnership. The intention of the survey is to assess stakeholder perception of whether DaVinci Academy is fulfilling the mission in these three areas. This presentation will present a literature review, data collection instruments designed for each of the stakeholders and a discussion of the process by which this project is moving forward.

# Roles of TRIL in Nodal Signaling during Xenopus Development

Hannah Wagner (Utah State University); Yangsook Song Green (University of Utah); Jan Christian (University of Utah)
*Faculty Mentor: Jan Christian*

During early embryonic development of Xenopus, correct levels of Nodal signaling are important for gastrulation and head formation. It is thought that TRIL, a transmembrane protein, represses Nodal signaling. Embryos that have TRIL expression reduced by morpholino injection do not correctly undergo gastrulation nor head development and expression levels of Nodal markers indicate an increase in Nodal signals. When TRIL is overexpressed, a similar phenotype to that of TRIL-knockdown embryos is observed. The phenotypes of several overexpressed TRIL deletion constructs indicate that the intracellular domain of TRIL is required to repress Nodal activity. We hypothesize that TRIL significantly prevents Nodal signaling, leading to defects, and that the intracellular domain of TRIL is necessary for TRIL function. Using PCR, expression levels of Nodal markers in embryos injected with TRIL deletion constructs showed that full-length TRIL unexpectedly increased Nodal activity. Also, all constructs that contained the TRIL intracellular domain increased Nodal activity. Whole mount in situ hybridization (WMISH) was used to examine expression of Nodal markers in an endogenous state. Although there was a larger amount of variation, the results of WMISH also suggest that full-length TRIL increases Nodal activity. A western blot for the molecule pSmad2, an indicator of Nodal activity, gave a similar result. Taken together, these results suggest that exogenous TRIL does not repress Nodal activity but may block endogenous TRIL function when overexpressed, and the intracellular domain of TRIL is necessary for TRIL to function in conjunction with the Nodal signaling pathway.

# Transforming Utah: Focusing on How Transgender Persons Negotiate Their Identities

Mathew Walker (Weber State University); Kylee Hallows (Weber State University)
*Faculty Mentor: Colleen Packer*

With celebrities like Caitlyn Jenner, Laverne Cox, and Chaz Bono coming out as transgender and a Primetime TV show which focuses on a transgender person, Transparent, winning multiple Emmy awards, the frequency of conversations focused on what it means to be a transgender person has increased across the nation. Despite its conservative political and religious background, Utah is no exception to having these conversations. Although positive views on transgender persons have increased, many transgender persons still must fight for acceptance. Through a thematic content analysis of three personal interviews, three published interviews, and two published narratives, this study examines the conversation of Utahans who have come out as transgender. Research suggests that a transgender person either feels the need to "pass" as male or female or identifies within a societal construct of gender outside the male/female dichotomy (Roen, 2001). This study uses Transgender Theory [which combines Queer Theory's notion of gender being a fluid social construct and Feminist Theory's notion that the treatment of gender is unequal (Nagoshi & Brzuzy, 2010)] as a theoretical foundation to analyze the acceptance of transgender persons across different stages of transition - from those who have chosen not to transition to those who have completed the transition process. The major theme that emerged from the data was that transgender self-identification influences acceptance levels from other transgender and non-transgender people. Results suggest that transgender people who attempt to "pass" as male or female experience stronger acceptance from non-transgender persons than the transgender people who identify themselves outside of the male/female binary. This information can be important to transgender people as they strive for acceptance and negotiate their identities in a conservative culture.

# In Vitro Evaluation of Silver Nanoparticles to Treat Acute Sinusitis

Fei Wang (University of Utah)
*Faculty Mentor: David Grainger*

In Vitro Evaluation of Silver Nanoparticles to Treat Acute Sinusitis UCUR Abstract Fei Wang Department of Bioengineering, University of Utah Acute sinusitis affects 16% of U.S. population, with more than 30 million annual diagnoses. Acute sinusitis is a bacterial infection of the upper respiratory tract, which is caused by inflammation of the paranasal sinuses and nasal cavity. Common treatments including antibiotic therapy, decongestants, and nasal saline irrigation can be ineffective because of the drug resistant pathogens and short duration of relief from nasal congestion. Silver nanoparticles (AgNPs) are expected to provide effective treatment for acute sinusitis, because they have demonstrated potent antimicrobial properties with decreased bacterial resistance and the ability to provide continuous silver ion delivery to infected tissue sites. Despite extensive research using AgNPs to treat a variety of diseases, there has not been a study that uses AgNPs to treat acute sinusitis. The goal of this study was to provide a better treatment for acute sinusitis via bactericidal ability of AgNPs. Therefore, it was hypothesized that silver ions, produced from silver nanoparticles, would be effective for killing bacteria responsible for acute sinusitis with minimum cytotoxicity to nasal epithelial cells. To test the hypothesis, the release of silver ions from AgNPs was determined by measuring UV absorbance of 10 ppm AgNP solution (prepared in ASTM grade II water, PH=7) at room temperature over 4 hours using a UV spectrophotometer and was tested using ICP-MS after different conditioned AgNP samples were placed in room temperature for 12 days; the minimum inhibitory (MIC) and the minimum bactericidal (MBC) concentrations of AgNPs were determined for their ability to eliminate 5x105 colony forming units (CFU) of Haemophilus influenzae (H. influenzae) and Streptococcus pneumoniae (S. pneumoniae), the primary pathogens associated with cause acute sinusitis. Human nasal epithelial cells viability was determined after exposure to an AgNP solution over 24 hours to evaluate toxicity of AgNPs. Absolute values of optical absorbance indicated an AgNPs ion release rate equivalent to 0.1 ppm/hour, with minimal particle aggregation. ICP-MS results showed silver ion percentage was increased from 2.15% to 13% over 12 days. The MBC and the MIC of AgNPs against H. influenzae and S. pneumoniae were about 3 ppm, 2.6 ppm and 2.5 ppm, 7 ppm respectively. The human nasal epithelial cell viability data showed viable cells up to 20 ppm of AgNP solution exposure, and the safe margin for AgNP administration is 15 ppm to 30 ppm. Preliminary studies validated that silver nanoparticles could provide persistent release of silver ions, which were effective at killing bacteria responsible for acute sinusitis with minimal toxicity to human cells. Therefore, the goal is to evaluate the feasibility of AgNPs to reduce the incidence of acute sinusitis.

# Effect of Cumulative vs. Non-cumulative Assessments on Student Learning in an Introductory Biology Course

Kurt Williams (Brigham Young University); Nicole Rice (Brigham Young University); Michelle Baek (Brigham Young University); Nicholas Nelson (Brigham Young University); Shannon Rose (Brigham Young University); Patrick Stockdale (Brigham Young University); Elizabeth Gibbons Bailey (Brigham Young University)
*Faculty Mentor: Elizabeth Gibbons Bailey*

Assessment has long played an important role as a measurement tool of student mastery over course content. However, testing has also been shown to be an effective learning tool in its own right. Assessments need not be only tests of learning, but can also be tests for learning. Previous research has shown that one way to transform exams from being metrical to learning tools is increasing frequency of assessment. Typical undergraduate courses rely on midterm exams; unpublished data suggest that smaller, more frequent assessments significantly increase student learning. Growing evidence supports the idea that cumulative assessments promote student learning more than traditional, non-cumulative exams. The purpose of the present study is to investigate the effects of cumulative vs. non-cumulative assessments on student learning within the model of smaller, more frequent exams. While cumulative assessments provide repeated exposure to course content, non-cumulative assessments provide opportunities to test course material with greater focus. In this study, one section of an introductory biology course for non-majors is given cumulative assessments, with about half of the questions drawn from previous units and the rest covering the current unit. The other section is given non-cumulative assessments, with the entire assessment drawn from current material. All other instructional techniques will be identical between both sections: same lectures, same assignments, same class activities, etc. At the end of the semester, student learning will be analyzed by comparing scores on a common final exam for the two sections, controlling for student reasoning ability upon entrance to the class. Attitudinal data will also be gathered to investigate student attitudes toward cumulative vs. non-cumulative assessments.

# Benefit Corporations: A New Take on Capitalism

Hannah Winward (Utah State University)
*Faculty Mentor: Jared Colton*

The purpose of my research is to examine the ethics of Cotopaxi, a company adopting a new type of business model: the benefit corporation. Cotopaxi is an outdoor gear company whose mission is to “disrupt the outdoor industry and inspire companies to do more for the world.” They accomplish this by giving 10% of their profit to humanitarian aid partner organizations that fund projects around the world. When the company's founder Davis Smith was starting up, he was told that no one would invest in a company that gave so much away. Although Cotopaxi is only one and a half years old, Smith believes that capitalism can include benefit corporations and companies where giving back is "ingrained into...corporate DNA." But does Cotopaxi’s ethics match its rhetoric? My research method is a virtue ethics analysis. Unlike utilitarian or rule-based ethics, which focus on what’s best for the majority and rationally produced rule-following, virtue ethics states that an action is moral when it correlates with a community’s values. Therefore, I will analyze the company’s actions through a variety of media, its website, interviews, news articles, etc. I will conclude that Cotopaxi is a business we can and should pay attention to for the future of capitalism. Some of the values capitalism is based upon include autonomy, providing goods and services, hard work, discipline, innovation, building the community, and the proliferation of ideas. However, many virtue ethicists see modern capitalism as a system valuing power, money, and competition over these values. Cotopaxi’s success as a benefit corporation is significant because it shows that a corporation that values giving back to the community, funding sustainable poverty relief, and moving others to make a positive difference in the world can be successful in a capitalist society.

# PMMA Formula Modification through the Preinfiltration and Infiltration Times to Create Optimal Product for Immunohistochemistry Studies

Amy Yu (University of Utah); Kaitlynn Castolene (University of Utah)
*Faculty Mentor: Kent N. Bachus*

Approximately 185,000 amputations are performed in the United States annually. The current standard of care for limb loss patients is the suspension-type attachment of an exoprosthesis to the residual limb. However, it is not suitable for all amputees. Patients often experience discomfort and pain, even when they have been successfully fitted with suspension-type attachments. It is for these patients that the Percutaneous Osseointegrated Docking System (PODS), an alternative docking system, are being developed. PODS devices are titanium alloy (Ti6Al4V) implants that use host bone to anchor the implant into the medullary canal of an amputated limb. During development, embedment of prototype PODS device in polymethyl methacrylate (PMMA) allows sectioning, staining, and evaluation of the body's histological response to the device implantation. Various PMMA formulas are being used in different laboratories throughout the country, with mixed results. These formulas are not suitable for immunohistochemistry (IHC) studies as they often generate high temperature during polymerization which causes degradation of cellular and protein structures. This project focuses on identifying the preinfiltration and infiltration times needed to produce and replicate an optimal PMMA product by modification of an existing formula (Technovit 9100 NEW kit). This optimal PMMA product will exhibit less heat during polymerization in the shortest amount of time and allow successful preservation of cellular structures for IHC studies. Nine groups of three specimens will be embed with the Technovit 9100 NEW kit (Energy Beam Sciences, East Gran by CT). These groups are randomly assigned to various combinations of preinfiltration and infiltration times. The embedment process of each combination is then measured and recorded. The specific combination that polymerize the fastest will be identified by the integrity of the embedded sample. The best PMMA embedment with the least amount of polymerization time and sample damage will be identified and replicated for validation of the process. We anticipate the optimal PMMA product will be produced by the two hour preinfiltration time and two hour infiltration time combination. This optimal PMMA product will exhibit fast low temperature polymerization and allow successful preservation of cellular structures for IHC studies.

# How do nuclear scientists and engineers talk internally among themselves about the Fukushima energy crisis?

Haoran Yu (University of Utah)
*Faculty Mentor: Danielle Endres*

This project examines how scientists and engineers researching low-carbon energy technologies talk among themselves about the social, political, and cultural implications of their research. It is part of professor Endres' NSF Collaborative Research Project: The Influence of Low-Carbon Energy Technology Scientists and Engineers on the Composition of Energy Policy. That project examines discussions among scientists and engineers about low-carbon energy technologies, particularly within two distinct but related energy technology sectors: wind, and nuclear. My research question is: How do nuclear scientists and engineers talk internally among themselves about the Fukushima energy crisis? I am particularly interested in examining the role that the Fukushima crisis has on the way energy scientists and engineers talk about the future of energy technologies in the context of climate change and the need for new energy policy. The significance of this research for this paper is first, since climate change has become an important topic, it is important to see how scientist talk about it as a sociopolitical issue in addition to its technical viability; second, there is a gap in rhetoric of science research about how scientists talk among themselves about the sociopolitical aspects of their research. In this research paper, I will analyze a subset of the data collected by the research team using NVivo qualitative analysis software. The methods are rhetorical and qualitative. Qualitative research is used to collect the data, which is based on participant observation and interviews with key scientists and engineers at the American Nuclear Society conference. This data has been collected already by other members of the research team. Rhetorical methods, which analyze strategies of persuasive discourse , such as narration, description, exposition, and argumentation will be used to analyze the internal expert-to-expert rhetoric of wind and nuclear energy scientists and engineers to examine what sociopolitical aspects are important to scientists and engineers. Our potential findings are: first, description of the ways scientists are talking about Fukushima is valuable because it has not been researched before and will add to scholarship in rhetoric of science. Second, there is potential to contribute to our understanding of the role that scientists and engineers have in the development of energy policy. This research is part of a larger collaborative research project that involves the PI (Professor Endres), two graduate students, and myself. This project represents an analysis of one part of the larger data set, in which I will be able to perform an analysis that contributes to the larger project. The results of this analysis, once completed, will be incorporated into the larger research project and hopefully integrated into a collaborative presentation or publication.

# Creation and Optimization of a Logo Recognition System

Michael Zhao (University of Utah); Haozhi Qi (Hong Kong University of Science and Technology); Xiaohui Zeng (Hong Kong University of Science and Technology); Owen Richfield (Tulane University); Sun Lin (Lenovo Research HK)
*Faculty Mentor: Yin Bon Ku*

We evaluate the performance of a classical image retrieval pipeline (visual bag of words model), using SURF descriptors and hierarchical k-means vector quantization with an inverted file index, and compare this to the performance of two convolutional neural network (AlexNet and GoogLeNet) pipelines when it comes to the task of recognizing logos. We analyze how various parameters of the clustering algorithm affect the accuracy of the visual bag of words model, as well as why the visual bag of words model fails to perform well in this domain. We also provide timing data for a practical use case, where these pipelines are incorporated into a logo recognition app for Android phones. Further directions include, for instance, investigations on how the choice of quantization method affects accuracy, and more scalable ways to incorporate deep learning into the pipeline. This project was supervised by Lenovo under the IPAM program Research in Industrial Projects for Students in Hong Kong.