Office of
UNDERGRADUATE RESEARCH
THE UNIVERSITY OF UTAH

2019 Summer Symposium

THURSDAY, AUGUST 1, 2019
9:00AM - 12:00PM
ALUMNI HOUSE
UNIVERSITY OF UTAH

2019 SUMMER SYMPOSIUM

Thursday, August 1, 2019
9:00 AM – 12:00 PM
Alumni House Ballroom
University of Utah

The Office of Undergraduate Research is grateful for the generous support of the Office of the Vice President for Research.

We are also thankful for the Summer Programs Partnership, which is a collaboration among the Chemistry Research Experience for Undergraduates (REU), the Genomics Summer Research for Minorities (GSRM) Internship, the Huntsman Cancer Institute's PathMaker Cancer Research Program, the Native American Summer Research Internship (NARI), the Physics & Astronomy REU and Summer Undergraduate Research Program, and the Summer Program for Undergraduate Research (SPUR). Together, these programs are serving more than 110 undergraduate researchers in Summer 2019.

Finally, we would like to express our utmost pride and congratulations to the students, graduate students, and faculty mentors without whose efforts and dedication this event would not be possible.

PROGRAM SCHEDULE

NOTE: All student presenters MUST check-in

Snacks available at 10:00 AM in the Ballroom

8:30 – 9:00 AM	**CHECK-IN & POSTER SET-UP**
9:00 – 10:25 AM	**POSTER SESSION I**
10:35 AM – 12:00 PM	**POSTER SESSION II**
12:00 – 12:15 PM	**POSTER TAKE-DOWN**

SCHEDULE OF PRESENTATIONS

POSTER SESSION I
9:00 – 10:25 AM

Poster 1
Presenters: Cathleen Zhang (University of Utah), **Elizabeth Izampuye** (University of Utah)
Mentor: Akiko Kamimura (Sociology)
Exploring the Relationship Between Patient Satisfaction and Expectations among Free Clinic Patients

People have the right to fully participate in the planning and implementation of their healthcare. In health policy, patient feedback is often used to better the policies that hospitals, clinics, and other healthcare organizations use in improving or changing their health delivery methods. It is pertinent that providers know what patients expect for the care they receive so that they can address them in a timely and efficient manner, better meet the patient's, and increase patient satisfaction. Relatively few studies have looked into the expectations and satisfaction levels of free clinic patients who are low income and uninsured. Socioeconomic factors play a large role in what expectations-both idealistic and realistic-patients may have of their treatment, and thus their satisfaction with their treatment. This study evaluated the expectations that patients utilizing a free clinic had about their treatment, as well as their satisfaction with the health care services that this clinic provided. Paper-self-administered survey data were collected from patients 18 years of age or older, who use the Maliheh Free Clinic in Salt Lake City, Utah. The sample was from both Spanish speaking and non-Spanish speaking patients. In general, there was no difference for patient satisfaction among subjects. Non-U.S. born Spanish speaking patients were more satisfied with their treatment than U.S. born English speakers when it came to sub-factors such as consultation with a physician and receptionist attitude. Patients who had been at the clinic for two or more years, had higher education attainment, and lower levels of satisfaction with consultation and treatment tended to have higher expectations. Along with highlighting the needs of free clinic patients, the results of this proposed study will help improve the quality of care for underserved populations.

Poster 2
Presenter: Anna Iacovino (Duquesne University)
Mentor: Amanda Bubas (Chemistry)
Characterization of UFn+ and UFn Species

Studies related to the fundamental reactivity of the actinides, specifically uranium, continue to be of interest to provide a foundation for the development of improved nuclear fuel reprocessing methods and advanced separation techniques for the recovery of uranium from seawater. Uranium fluorides are particularly relevant, as UF6 is often present in nuclear reactors. Understanding the intrinsic reactivity of UFn and UFn+ species in the gas phase, free of solvent effects, provides a direct comparison for predicting reactions that may occur when nuclear material is accidentally exposed to the environment. Guided ion beam tandem mass spectrometry (GIBMS) and quantum chemical calculations were used to characterize neutral and cationic uranium fluoride complexes. A DC-discharge ion source was used to generate an abundance of uranium cations. The GIBMS used in this study employs a magnetic momentum analyzer for selection of a specific precursor ion for reaction with SF6 over a wide range of kinetic energies. The products of these ion-molecule reactions are mass analyzed and detected using a quadrupole mass filter and Daly type detector, respectively. Density functional theory (DFT) calculations were performed at multiple levels of theory (B3LYP, M06) incorporating a variety of basis sets using Gaussian16. Products observed for the reaction of U+ with SF6 include UFn+ (n=1-4) + SF6-n and SFm+ (m=1-5) + UF6-m. All channels indicate that these products form exothermically, and formation of UF2+ + SF4 and UF3+ + SF3 appear to be especially efficient. DFT calculations with supporting energetics will also be presented.

Poster 3
Presenter: Jazmine Abril (University of New Mexico)
Mentor: Angie Fagerlin (Population Health Sciences)
Demographic and psychological associations with Zika preventive behavioral intentions

There are multiple behaviors people can engage in to prevent the spread of an infectious disease during an epidemic, yet they often do not engage in these behaviors. In this cross-sectional study, we sought to determine the public's willingness to engage in Zika preventive behaviors across three time points during the Zika pandemic of 2016. National representative samples were recruited through an online survey company (Survey Sampling International) across three different time points: Time 1 was March 2016, Time 2, was August 2016, and Time 3 was March 2017. Participants read through a short description of the Zika Virus developed by the Centers for Disease Control and Prevention then completed questions regarding their preventive behavior intentions (e.g., wearing long sleeve clothes, avoiding going

outside), psychological characteristics (e.g., trust, perceived risk, worry), and demographics (e.g., gender, age, race/ethnicity). We hypothesized that behavioral intentions would be highest at Time 2 and that demographic and psychological characteristics would be associated with protective behavioral intentions. Our preliminary data has supported our hypothesis in relation to the role of behavioral intentions over time. Additionally, our results indicate a positive association between anxiety, perceived susceptibility, and perceived severity with greater behavioral intentions. However, more research is needed to further explore potential moderators of preventive actions, as well as the use of these moderators in possible interventions to increase protective-health behaviors within populations.

Poster 4

Presenter: Manisha Adhikari (High School Student)
Mentor: Jen Doherty (Population Health Sciences)
Incidence Patterns of Common Cancer Types Among Pacific Islanders in Utah

Utah has the fifth largest Pacific Islander population in the continental United States. We examined Utah age-adjusted incidence rates for common cancer types in the United States by race/ethnicity, focusing on rates with the greatest differences between non-Hispanic whites (NHW) and Native Hawaiian or Other Pacific Islanders (PI). We assessed age-adjusted percentages of selected risk factors and screening usage for cancer types with screening tests available. We utilized state-wide cancer data and Behavioral Risk Factor Surveillance System (BRFSS) interview data from Utah's Public Health Indicator Based Information System (IBIS) from 2005-2015. We observed increased risk of several cancer types for PI compared to NHW in Utah. The largest difference was for uterine corpus cancer at 108 per 100,000 (95% Confidence Interval (CI): 85-135) in PI compared to 25 (95% CI: 24-26) in NHW, followed by female breast cancer at 145 per 100,000 (95% CI: 114-182) in PI compared to 117 (95% CI: 115-119) in NHW, then by prostate cancer at 175 per 100,000 (95% CI: 135-224) in PI compared to 151 (95% CI: 149-154) in NHW. Compared to NHWs, PIs had a 22% higher age-adjusted prevalence of overweight and obesity, which are risk factors for uterine corpus, breast, and prostate cancers, as well as several other cancer types. Only 11% of NHW had no health insurance compared to 28% of PIs, but the proportion of women who had had a mammogram in the past two years and the proportion of men who ever received a PSA test were similar in NHW and PIs. Further research is needed to fully understand what factors may be contributing to the high incidence of these cancer types in the Utah PI population in order to determine prevention strategies and/or improve uptake of screening.

Poster 5

Presenter: Olivia Dale (University of Utah)
Mentor: Michael Simpson (Metallurgical Engineering)
Metal Dissolution in Molten Salts for Redox Control

Molten chloride salts have great potential for higher efficiency heat transfer compared to nitrate-based salts. The chloride-based salts can operate at higher temperatures and in turn produce more electricity. The redox potential of the chloride salts is much greater at higher temperatures and can easily corrode common alloys. In this study, the electrochemical effect of adding magnesium metal to a $MgCl_2$-KCl-NaCl salt mixture was investigated. The solubility of the magnesium in the $MgCl_2$-KCl-NaCl salt mixture was analyzed at different temperatures to determine the maximum saturation point. Through open circuit potentiometry it can be seen that the redox potential of the salt decreased when magnesium was added. Cyclic voltammetry shows both a reduction and oxidation peak, with the reduction peak being greater in size. These results signify that the addition magnesium metal could be an advantageous medium to control redox potential in the $MgCl_2$-KCl-NaCl salt.

Poster 6

Presenter: Andrew White (California Lutheran University)
Mentor: Daniel Leung (Pediatrics)
Cytokine Responses of Mucosal-Associated Invariant T cells

Intestinal infections are one of the largest global contributors to death among young children in countries with limited resources. Development of an effective vaccine can positively affect societies that have low resources and little accessibility to health care. Mucosal-Associated Invariant T (MAIT) cells are effector innate-like T cells, which are abundant in human mucosal tissues, and have the capacity to be active in environments that are suitable for bacterial infection. Knowledge of the role of MAIT cells in the immune system and how they combat these mucosal infections could be an important step towards making better vaccines. Gaps in our understanding of MAIT cells include the type of environment and the exact mechanisms by which MAIT cells fight off these infections. When invaded, host cells either release cytokines or initiate MAIT activation via a riboflavin intermediate that is presented by MHC-related antigen-presenting protein, MR1. Upon activation, MAIT cells release TNFα and IFNγ, which likely reflect the extent of activated

MAIT cells in a given sample. For this experiment, we will use supernatant generated by MAIT cells extracted from human blood samples following a stimulation assay. In order to qualitatively measure these biomarkers, we will use sandwich ELISA to assay for selected cytokines. We will also measure these biomarkers by flow cytometry. This will help define which conditions are best for MAIT cell activation. Understanding this could provide critical information to how the immune system can be effective in responding to bacterial invasion. This discovery will greatly benefit the field of Infectious Diseases and potentially save countless lives.

Poster 7

Presenter: Vivek Vankayalapati (University of Utah)
Mentor: Daniel Wik (Physics & Astronomy)
Shocked Electrons: Determination of the Heating Mechanism in Abell 665

Mergers between galaxy clusters are some of the most energetic events in the universe, driving shock fronts in the intracluster medium (ICM), a plasma permeating the cluster. Shock fronts heat thermal electrons, causing an increase in their temperature. The mechanism by which this occurs is undetermined, with two models being proposed to explain the phenomenon. The first proposes direct shock-heating and the second suggests indirect adiabatic compression, with the electrons subsequently equilibrating with ions heated by the shock. We utilize *NuSTAR* observations of a shock in the merging cluster Abell 665 in order to discriminate between the models. To do so, a temperature profile was constructed across the shock, utilizing spectral fitting, in order to compare against the models' predictions. In addition, temperature maps across the cluster are generated in order to understand the merger event as a whole. We find that the temperature profile is suggestive of the shock model but not statistically significant, due to *NuSTAR*'s comparatively worse spatial resolution. Future work will involve joint fitting the *NuSTAR* data with *Chandra* observations in order to statistically distinguish between the models for the first time. Understanding these processes increases our understanding of the magnetic field of the ICM, which in turn allows for mass determination, allowing galaxy clusters to be used to constrain cosmological studies.

Poster 8

Presenter: Jacob Young (University of Utah)
Mentor: Jared Rawlings (School of Music)
BULLYING, PEER GROUPS, AND MUSIC PARTICIPATION: THE SOCIALIZATION OF BULLYING BEHAVIOR IN ADOLESCENCE

School violence has emerged in the last ten years as a significant public health crisis that include behaviors ranging from bullying, hate-based language, sexual harassment, and physical assaults (Robers, Kemp, & Truman, 2013). A recent study found that almost one-third of students in grades 6-12 reported they had been victimized by peers, and 5% to 13% admitted to bullying others (Hymel & Swearer, 2015). Researchers in music education acknowledge peer victimization and bullying is also a serious concern for music students (Elpus & Carter, 2016; Silveira & Hudson, 2015; Rawlings, 2015, 2016). Elpus and Carter (2016) examined data from the 2005, 2007, 2009, 2011, and 2013 datasets of the School Crime Supplement to the National Crime Victimization Survey (NCVS) to determine the prevalence of reported school victimization through physical, verbal, and relational aggression among US performing arts students. Elpus and Carter found that male music and theater students are at a 69% greater risk than non-arts students when experiencing face-to-face bully victimization and male music and theatre students were confronted with a 63% greater risk of being cyber bullied than non-arts participants. Therefore, if school music students may be more likely to be targets of victimization and feel unsafe at school when compared to their non-music peers, then research is needed to determine the prevalence of these behaviors and document detailed instances of this phenomenon. To date, there has been no published research examining the the prosocial and anti-social behavior development of school-based music ensemble performers.

Poster 9

Presenter: Clare Johnson (Morehead State University)
Mentor: Ryan Looper (Chemistry)
Synthesis of Prokaryotic P-Site Inhibitor Amicetin Analogues for Treatment of Multi-Drug Resistant Tuberculosis (MDR-TB) with Human Immunodeficiency Virus (HIV) Coinfection

The World Health Organization (WHO) has identified antimicrobial resistance as a top 10 global health threat due to improper use and lack of novel antibiotic scaffolds and mechanisms of action. According to the Centers for Disease Control, multidrug-resistant *Mycobacterium tuberculosis* (MDR-TB) is considered a "serious threat" and is among the most frequent causes of death worldwide. This project serves to build upon previous generations of syntheses done by the Looper Lab on the natural product Amicetin (Ami), a candidate for an amino-hexose cytosine antibiotic used in the treatment of MDR-TB with Human Immunodeficiency Virus (HIV) coinfection. Synthesis of Ami analogues is aimed to improve penetrance through the membrane while remaining at safe levels of toxicity by altering the polarity of the

eastern molecule fragment. This project reports on synthetic methods used to construct these analogues and will provide insight to be used in further studies of analogue syntheses to one day develop an effective antibiotic to combat MDR-TB.

Poster 10

Presenter: James Banks (University of Utah)
Mentor: Claudio Villanueva (Biochemistry)
Glycogen Synthase Regulation in Brown Adipose Tissue

The ability of brown adipose tissue (BAT) to utilize glucose makes it a promising therapeutic target to treat conditions such as obesity and diabetes. During cold exposure or through β3-adrenergic receptor stimulation by agonists like CL-316,243, BAT utilizes substantial amounts of glucose and lipids to fuel the process of thermogenesis. In order to understand the metabolic fate of glucose in active BAT we used stable isotope tracing technique (U-^{13}C-glucose) to follow the ^{13}C incorporation into various metabolites. This method suggested that glucose is partially diverted to UDP glucose, an important factor in glycogen synthesis pathway. This prompted us to measure overall glycogen levels in BAT and glucose incorporation into glycogen. Our data shows that CL-316,243 stimulation leads to more incorporation of glucose into glycogen but also stimulates its subsequent degradation leading to less overall glycogen in the cell. This observation is followed by increased protein levels of glycogen synthase (GS), an enzyme needed for glucose incorporation into glycogen. The role of GS in glucose homeostasis is well studied in liver and skeletal muscle. However, its regulation and role in BAT glucose metabolism is not established. In order to do so, we plan on using CRISPR-Cas9 to screen for genes associated with the expression of GYS1 (gene that codes for GS in brown fat). Additionally, proximity labeling will be done to see what proteins are interacting with GS during BAT activation. Elucidating these mechanisms will contribute to the development of new treatment strategies that can improve glucose control.

Poster 11

Presenter: Damon Greenberry (University of Utah)
Mentor: Jennifer Ose (Population Health Sciences)
Metabolomic profiles of CRC risk overall and by specific subtypes

BACKGROUND: Colorectal cancer remains the third leading cause of cancer-related death worldwide. Although improved screening and early detection have substantial improved survival rates in colorectal cancer, there are newly arising populations at risk. There is sparse evidence on the etiology across these distinct subtypes that can be characterized by tumor location, sex and age at diagnosis. **OBJECTIVE:** With this review, we aim to enhance our understanding of the etiology of colorectal cancer overall and for specific subtypes, screening the published literature for studies investigating metabolomic profiles in serum and plasma and how these are related to colorectal cancer risk. The gained knowledge will be used to support a grant application to the National Cancer Institute (NCI) that is currently underway and using data from eight large-scale prospective cohort studies investigating the association of metabolomics profiles with colorectal cancer risk. **METHODS:** We will conduct our scoping review using the five stages framework established by Arksey and O'Malley. An information specialist (MM) will develop search strategies for the following databases: Medline, Embase, CINAHL Complete, Cochrane Library, Scopus, and Web of Science. We will be using the PRISMA checklist for our review and the Covidence® software to screen titles and abstracts. Metaboanalyst software will be used to identify metabolomics pathways related to 24 metabolites from the research project that will be submitted to NCI. The results of the literature research will be used to generate the evidence base for the grant submission. **RESULTS:** Our initial data elements include: First Author, Year of Publication, Origin, Journal, Aim of study, Population, Study Type, Race/Ethnicity, Country, Sex, Pathways identified, Biospecimen Used, Metabolites Identified, Age, Stage, q-Value, Comparator, and Method. Currently undergoing is the screening of titles and abstracts of >2,000 articles. **DISCUSSION:** We hope to find more insight on the etiology of CRC overall and for distinct subtypes.

Poster 12

Presenter: Alyssa Castor (University of Utah)
Mentor: Sara Grineski (Sociology)
Social Disparities in Exposure to Accidental Releases of Chemical Toxins in the Texas Gulf Coast Area After Hurricane Harvey

On August 25, 2017, Hurricane Harvey made landfall along the Texas Gulf Coast, causing unprecedented rainfall, flash flooding, and winds. Flooding, lightning strikes, and power failures led to fires, explosions, and shutdowns, resulting in unplanned releases of hazardous chemicals into the air and floodwaters. To understand the environmental justice implications of these accidental releases, we analyzed social inequalities in the residential exposure to chemical toxins in 1118 census tracts along the Texas Gulf Coast, near Houston, Texas. This study utilized reports from the Texas Commission on Environmental Quality (TCEQ) to characterize accidental releases from each refinery event related to

Hurricane Harvey. In total, we examined 1823 releases from 58 facilities between August 26, 2017 and September 27, 2017. We geocoded the facilities and calculated a census tract-level Hazard Density Index (HDI) in ArcGIS 10 software using a 1 km buffer around each facility to give each census tract a hazard score based on the density of refineries with accidental releases in each tract. We paired those HDI scores with sociodemographic data from the 2013-2017 American Community Survey pertaining to race/ethnicity, age, household income, disability and access to a vehicle. Census tract-level data were analyzed using spatial error multivariate regression models, which account for spatial autocorrelation. We found that census tracts with greater percentages of racial/ethnic minorities ($p<0.001$) and residents without access to a vehicle ($p<.004$) faced greater exposure to petrochemical releases after Harvey. Our results provide evidence of environmental injustices based on race/ethnicity and transportation disadvantage in the Gulf Coast area after Harvey. Results speak to the importance of shutting down operations at petrochemical facilities in advance of storms as planned shutdowns result in fewer releases. This would better protect the health of nearby communities with relatively high concentrations of racial/ethnic minority and transportation-disadvantaged residents.

Poster 13

Presenter: Drisanna Watson (University of Maine, Orono)
Mentor: Venkata Yellepeddi (Pediatrics)
Prediction of Plasma and Salivary Pharmacokinetics of Atropine in Pediatric Sialorrhea patients using a PBPK Modeling Approach.

Sialorrhea is excessive salivation and is a significant quality of life issue in children with neurodevelopmental disorders. Sialorrhea is currently treated off-label using adult formulations of anticholinergic agents such as atropine. Sublingual administration of atropine eye drops is the present approach for the treatment of sialorrhea because of the low-cost and easy availability. However, due to its off-label use, there are no approved pediatric dosing guidelines for atropine in sialorrhea. We hypothesize that a validated physiologically based pharmacokinetic model (PBPK) of atropine can be used to predict the blood plasma and salivary pharmacokinetics of atropine in children across various age groups. A validated PBPK model can, therefore, be used to develop dosing recommendations for atropine in pediatric sialorrhea patients. The PBPK model was developed using PK-Sim® Version 8, software. The input parameters for atropine were obtained from the published literature. The simulations of atropine pharmacokinetics after oral administration were performed in virtual pediatric populations with age groups: 0-5, 6-10, 11-15, and 16-21 years. The pharmacokinetic parameters maximum plasma concentration (Cmax), half-life (T1/2), and Area Under the Curve (AUC0-∞) of atropine in plasma and saliva were calculated using PK Sim®. Our results indicated that the plasma and salivary pharmacokinetics varied significantly across all age groups studied. Specifically, AUC0-∞, a pharmacokinetic parameter representing bioavailability was approximately 3.5-fold lower in 16-21 years when compared to 0-5 years. The atropine PBPK model developed after validation with observed data can be used to develop an age-based dosing regimen of atropine in pediatric sialorrhea patients.

Poster 14

Presenter: Michelle Marrero-Garcia (University of Puerto Rico, Mayaguez Campus)
Mentor: Charles Jui (Physics & Astronomy)
Search for Photons of Galactic Origin Using TALE

A cosmic ray is a particle that comes from outer space and strikes our atmosphere creating a cascade of particles that continue to collide with nuclei in the atmosphere and emit fluorescence light in the ultraviolet part of the spectrum. As this process occurs, particles lose energy and reach a point where they can no longer create more particles from collisions. The depth at which this occurs is known as the atmospheric depth of the maximum of the shower, Xmax. Cosmic rays have been observed to strike with different energies, which leads to believe that the sources producing them are also different depending on the energy the cosmic ray strikes with. The origin and composition of cosmic rays are one of the greatest mysteries in the field, and this project focused on studying cosmic ray events with energies between 10^{15} eV – 10^{19} eV with the purpose of searching for photon candidates to try and identify possible sources of galactic cosmic rays. The events were recorded over the past four years using the fluorescence detector telescopes of the Telescope Array Low Energy Extension (TALE). Two sets of data were obtained and analyzed using ROOT. Each set was divided into 0.1 log10(energy) bins and, for each, the atmospheric depth of the maximum of the shower (Xmax) was plotted to look at the event composition. The plots were all compared to those obtained from Monte Carlo simulations, and, using a 90^{th} percentile cut for protons in the simulation, the data was also cut to obtain photon candidates in each log10(energy) bin. Finally, the resulting events containing photon candidates were plotted in the sky using an Aitoff projection to help identify possible sources.

Poster 15

Presenter: Elizabeth Hayes (University of Utah)
Mentor: Minna Roh-Johnson (Biochemistry)
Characterizing tumor cell dissemination through analyses of cell-matrix interactions

The leading cause for mortality in cancer patients is due to metastasis. Mechanistically identifying how the tumor cells disseminate *in vivo*, however, continues to evade healthcare professionals. Recently, focal adhesions have been shown to form in melanoma cells during migration in in vivo models. Focal adhesions are macromolecular structures formed on the leading edge of a cell that interact with the microenvironment and are known to be key regulators in cell migration. Bytargeting known proteins of focal adhesions, integrin and paxillin, we may be able to gain a better insight into the behavior and migratory patterns of tumor cells during dissemination within an organism. To do this, we fluorescently tagged integrin and paxillin through traditional cloning methods and transduced them into zebrafish melanoma cells to further visualize the focal adhesion-based dissemination behavior within transparent zebrafish. By characterizing the *in vivo* microenvironment of tumor cells, the clinical regulation of metastasis in cancer patients, and thus survival, may become a closer reality within healthcare.

Poster 16

Presenter: Camrey Tuttle (University of Utah)
Mentor: Sara Simonsen (Nursing)
Causes of Discontinuation of Fertility Treatments in Utah

Purposes: In response to legislature's desire to better understand the impact of infertility on Utahans, data from survey-based Fertility Experiences Study (FES) was analyzed to characterize the attitudes of those affected by such circumstances. The goal of this research is to describe the burdens reported by women receiving fertility treatments and the discontinuation of these treatments by the couple prior to achieving successful conception. Background: Previous works on this topic have shown discontinuation rates for fertility treatments of approximately 33.1%, with the most common causes from least to most common psychological/emotional distress; no faith in procedure; and medically advised to discontinue. Methods: This study utilizes the FES data to describe the frequency of discontinuation of fertility treatments and main reported reasons for discontinuation. The FES was contrived of surveys sent to Utahns in which women answered questions about their fertility treatments. Statistical analysis was performed using the software Microsoft excel to organize and compare participant responses. Results: Among 960 total study participants, 782 reported using at least one fertility treatment (alternative treatments, ovulation-enhancing medications, artificial insemination, or in-vitro fertilization). Of these participants, 144 (10%) reported that treatment(s) were discontinued before successful conception was achieved. Many participants reported that multiple reasons contributed to treatment discontinuation. The most prevalent reasons included: feeling like treatment was not working (56%), monetary cost (50%), and physical burden (49%). In addition to these factors, the emotional consequences of fertility treatments were analyzed. Increased stress levels and other emotional crisis were reported by a majority of participants, with the most impacted area being the participant's relationship with her partner.

Poster 17

Presenter: Noah Shepard (University of Utah)
Mentor: Rodrigo Noriega (Chemistry)
Molecular Dynamics and Charge Transfer at an Electrically-Charged Interface

Surfaces involved in charge transfer reactions, such as electrodes in energy storage and conversion devices, typically operate under the effects of electromagnetic fields. These fields are particularly important at the interface between different materials (e.g., solid/liquid), and strongly affect charged species in their vicinity. The purpose of this research project is to study molecular conformations and charge dynamics at an electrified interface and elucidate how these properties differ from those in the bulk solution. The first system we are examining in the interfacial region is the charge transfer complex of TCNB (tetracyanobenzene) and toluene. The complex formed by these two molecules undergoes a charge transfer reaction through stimulation by certain wavelengths of light. The charged species that result from this photolysis can be placed in the vicinity of an electrode to study charge extraction. By controlling variables such as the dielectric environment in which the reaction takes place, we will relate the macroscopic observable phenomena of charge extraction to the molecular-level charge dynamics observed with ultrafast laser spectroscopy. The second system we are testing is the effect of electric fields on the dynamic folding/unfolding of polylysine at a charged interface. A layer of polylysine will be placed in an ultra-thin flow cell and an aqueous solution of variable pH will pass through. The solution's pH changes the equilibrium state of polylysine between neutral helices (pH>10.6) and positively charged random coils (pH<10.6). These proteins will be attached to an ITO (indium tin oxide) electrode deposited on sapphire substrates, and the rate of change in molecular conformations will be studied as a function of surface potential.

Poster 18

Presenter: Yeng Yang (University of Wisconsin Madison)
Mentor: Kristen Kwan (Human Genetics)
The Role of Primary Cilia in the Developing Eye

Primary cilia are ubiquitous non-motile vertebrate organelles that coordinate key cellular processes during development. In humans, defects in cilia formation and/or function lead to congenital "ciliopathies" that affect multiple tissues and organs in the body. In the eye, ciliary dysfunction can lead to coloboma, a structural defect in the choroid fissure, a transient structure in the developing eye necessary for retinal axon exit and vasculature entry. Although coloboma is a significant cause of childhood blindness worldwide, the mechanisms underlying the choroid fissure development are not well understood. One important pathway for proper choroid fissure development is the Hedgehog (Hh) signaling pathway: disruptions in this pathway can cause coloboma in humans. Interestingly, in vertebrates, cilia act as central organelles for Hh pathway signal transduction. Studies have explored cilia and Hh signaling in different parts of the body, but little is known about their interaction in the early eye. We hypothesize that mutations that impair cilia lead to coloboma via disrupted Hh signaling. Due to their optical accessibility and rapid external development, zebrafish are an excellent model for studying choroid fissure development. Using multidimensional imaging and molecular genetics, we will investigate choroid fissure development in zebrafish *dzip1* mutants that lack primary cilia. Our preliminary evidence indicates that the *dzip1* mutants have coloboma. The goal of this project is to determine if the loss of cilia leads to dampened or hyperactivation of Hh signaling in the eye and pinpoint the specific morphogenetic defects leading to coloboma.

Poster 19

Presenter: Tan Le (University of Utah)
Mentor: Brandt Jones (School of Biological Sciences)
Germline Genetics and Tumor Genomics in Multiple Myeloma

Multiple myeloma (MM) is a malignancy of plasma cells in bone marrow, and one of the more common hematological malignancies (incidence 6.3/100,000 per year). Incidence continues to increase (0.8%/year), and though treatments have improved, only 50% of patients survive 5 years. Major obstacles to discoveries are a lack of family studies to identify inherited genetic factors, and inadequate understanding of tumor diversity and consequences. The identification of risk genes will advance efforts toward early detection and precision prevention. Improved characterization of tumors has potential for advancing genomic medicine through precision management and therapeutics. Using MM pedigrees from the Utah Population Database and previously identified MM risk genes USP45 and ARID1A, we developed a novel approach to define quantitative tumor dimensions from RNA expressions in tumors. Implementing Principal Component Analysis (PCA) of these tumor dimensions, we have identified 28 tumor dimensions out of the 768 MM tumors available. Preliminary analyses have identified dimensions associated with clinical cytogenetic tumor markers. Interestingly, an association was also found between African heritage and dimension 11 ($p=2.5x10-7$), indicating that tumor molecular heterogeneity may explain racial disparities seen in the incidence and prognosis of MM. We are collecting biological samples from MM patients to enable germline genetic and tumor genomic studies. These include: bone marrow and whole blood/saliva. Bone marrow is separated using flow cytometry into tumor cells (CD138+) and microenvironment cells (CD138-). DNA/RNA is extracted from these cell types. Germline DNA is extracted from whole blood and/or saliva. DNA/RNA from these extractions are sequenced, which will be the basis for future dimensional analysis of MM tumors. Family studies and tumor dimensions show promise as tools for gene discovery and characterization of myeloma tumors. In future work, we'll use these to investigate the ability to understand racial disparities and predict survival and response to treatment.

Poster 20

Presenter: Emily Yang (University of Utah)
Mentor: Ryan Steele (Chemistry)
Quantum Chemistry Simulations on the Structure and Vibrational Signatures of Tropine

One of the hallmark tenets of biochemistry is that structure dictates function. For biologically and pharmacologically relevant molecules, a determination of the structure of the compound--and the manner in which it changes upon interaction with other molecules--is a central scientific challenge. However, many molecules exhibit multiple low-energy structures (conformers), even at biologically relevant temperatures. In this work, the vibrational responses of tropine and its protonated analogue are used to explore the structure and structural diversity of these pharmaceutical mimics. Quantum chemistry-based computer simulations were employed to identify the low-energy conformers and their vibrational signatures, in order to predict and explain these molecules' response to infrared light in experiments. These calculations also allowed for an assessment of the energetic and spectral consequences of protonation on tropine.

Poster 21

Presenter: Jared Garcia (University of Montana Western)
Mentor: H Joseph Yost (Neurobiology & Anatomy)
The Cellular Mechanisms causing Neurodevelopmental Phenotypes in Kabuki Syndrome Zebrafish

The histone methyl-transferase KMT2D plays a critical role regulating gene expression through epigenetic mechanisms. Mutations in the *KMT2D* gene occur in 70% of patients with Kabuki Syndrome (KS). KS is a pediatric congenital disorder of genetic origin that affects the development of multiple organs systems, including craniofacial abnormalities, cardiovascular defects, and microcephaly. In our lab we generated a zebrafish model for KS that recapitulates the main clinical manifestations of the human KS. Zebrafish KS has a neurodevelopmental phenotype that consist of: reduced brain size, increased mitotic cells (pH3 marker), increased neuronal progenitors (Sox2 marker), decreased neuronal precursors (HuC/D marker) and decreased apoptosis (active capase 3 marker). Although there is a significant difference in neuronal types and cell proliferation in our zebrafish *kmt2d* null mutants, we don't know whether that phenotype is due to developmental delay or a neurogenesis defect. The objective of this study is to identify whether zebrafish KS neurodevelopment phenotype is due to impaired neurogenesis. In order to do so, we performed an EdU pulse and chase experiment. Zebrafish embryos at 24 hours post fertilization (hpf) were treated with EdU for 6 hours. After treatment period, samples were well washed and collected at 2 dpf and 3 dpf. Immunofluorescence against Sox2 and HuC/D was performed to label progenitor cells and neuronal precursors, respectively. Neurodevelopment phenotype was characterized Fluorescent Assisted Cell Sorting (FACS). DAPI was added in order to perform cell cycle profiling. Our detailed analysis will allow us to assess and quantify the fates of cells labeled at 24hpf, the status of their cell cycle and whether their lineages progress to neuronal precursors. Our preliminary results suggest that neurodevelopment defects in KS zebrafish is due to impaired neurogenesis and accumulation of cells in G2/M cell phase.

Poster 22

Presenter: Jonathan Davis (Utah Valley University)
Mentor: David Kieda (Physics & Astronomy)
A General Target Planner for use in Stellar Intensity Interferometry

Over the past decade, a renewed interest has taken place in using Stellar Intensity Interferometery (SII) for performing high angular resolution measurements of stars at visible wavelengths. Areas of study include studying stellar limb-darkening, rapid-rotators, and potentially performing model-independent imaging. A general purpose SII target planner has been created for determining the best stars to observe for any given night. The catalog is generalized and allows users to customize the catalog for a given observatory. Using information from seven different star catalogs, a master SII catalog is constructed. Stars are then ranked based on the ability to make stellar diameter estimates, which is dependent mainly on the estimated angular diameter and apparent brightness. Once stars are ranked, it also allows the user to perform a visual analysis of any of the given targets.

Poster 23

Presenter: Grayson Hull (University of Utah)
Mentor: Owen Chan (Internal Medicine)
Novel Somatostatin Receptor Antagonist Improves Glucagon Secretion in Diabetic Rats

Hypoglycemia is the most serious acute complication for type 1 diabetic (T1D) patients trying to reach optimal glycemic goals. Key to this is loss of the ability to secrete glucagon in response to hypoglycemia, which occurs within 5 years after the onset of diabetes. Glucagon is the primary hormone that helps to raise blood glucose levels back to normal when they begin to fall. Finding pharmacotherapies that can restore glucagon secretion from the pancreatic α-cells is crucial to helping prevent or reduce the incidence of hypoglycemia in patients with T1D. The regulation of glucagon secretion is controlled by multiple factors, one of which is somatostatin (SST). SST is a hormone that is secreted by pancreatic δ-cells and it acts through SST type 2a receptors (SSTR2a) to suppress glucagon secretion. In T1D, SST levels are elevated and it may contribute to loss of the glucagon response to hypoglycemia. Therefore, antagonists of SSTR2a may be a promising therapy to help restore this response. Streptozotocin (STZ)-diabetic rats were used to evaluate the efficacy of ZT-01, which is a new SSTR2a antagonist. Surgery to cannulate the left carotid and right jugular was performed on the rats one week after induction of diabetes. The animals were then subjected to a hyperinsulinemic-euglycemic-hypoglycemic clamp one week after surgery. The control group received injections of vehicle and the treatment groups received varying dosages of ZT-01 one hour prior to inducing hypoglycemia to find the lowest effective drug dose that would enhance glucagon secretion during hypoglycemia. We evaluated four different doses ranging from 0.3mg/kg to 0.1ug/kg. The most promising dose was 0.3mg/kg which increased glucagon secretion by almost 8-fold compared to vehicle-treated STZ rats. Lower doses exhibited a dose-dependent decline in efficacy with 0.1ug/kg showing no effect. In conclusion, our pre-clinical findings indicate that ZT-01 shows great potential as a therapy to improve glucagon secretion in rats with T1D.

Poster 24

Presenter: Zachary Whipple (University of Utah)
Mentor: Scott Anderson (Chemistry)
Production of fuel compatible, air stable nano particles.

Our project focuses on the production of high energy density nanoparticles for potential use as a fuel additive to increase overall volumetric energy density. A planetary mill was used to break down larger metal particles. While milling under typical industrial conditions will only reduce particles to the micron scale, the addition of a ligand or capping agent has been shown to favor nanoparticle size production. Aluminum nanoparticles were produced by milling under an argon atmosphere using acetonitrile to aid in particle size reduction. Perfluorotetradecanoic acid was mixed with the particles in solvent. This reaction yields air stable fluorocarbon capped aluminum nanoparticles that are fuel compatible. Combustion experiments comparing hydrocarbon and fluorocarbon capped particles were performed. Particles capped with fluorocarbons reacted much more robustly than hydrocarbon capped particles. The product of fluorocarbon capped particle combustion reactions were analyzed, revealing formation of both aluminum oxide and aluminum fluoride.

Poster 25

Presenter: Kunani Tuttle (University of Utah)
Mentor: Ilya Zharov (Chemistry)
Synthesis of Mesoporous Silica Nanoparticles for Targeted Alpha Therapy

Current cancer treatments such as chemotherapy and radiotherapy are among the most popular methods of treating cancer, but they cause detrimental side effects associated with cytotoxicity for healthy cells. A relatively new method called Targeted Alpha Therapy, using radioactive isotopes, shows potential to overcome these problems, but is still underexplored. This approach uses a small amount of a radioactive source and shows high selectivity in relation to the cancerous cells. Alpha decay causes a double DNA strand break and the particles can target specific cancer cells with no other tissue damage because alpha particle radiation confines its cytotoxic effect to a much smaller area (travel distance for alpha particle is $< 100\ \mu$m, while for beta irradiation it reaches 10 mm). To prevent the spreading of radioactive components to healthy tissues and the blood stream, the alpha particle source must be encapsulated in a rigid shell not distractible by alpha decay. The primary aim of this project is to develop a carrier for targeted delivery of the alpha particle source to the cancerous cells. Silica porous nanoparticles are the desired material to use because they are non-degradable, biologically compatible, relatively cheap, and are easily functionalized with peptides and antibodies. In this overall project, the silica nanoparticles were incubated with radioactive actinium then coated with more silica. Peptides on the silica coating will direct the particles to attack neuroendocrine tumors. In order to have viable silica nanoparticles that will work with targeted alpha therapy, we needed to synthesize nanoparticles that are monodispersed, spherical, less than 50-100 nm in size, and mesoporous to provide high surface area and porosity for actinium adsorption. By changing our silica sources, surfactants, and reaction conditions such as pH, temperature, and rate of addition of silica, we have been able to manipulate these characteristics and finally obtain monodisperse and highly mesoporous silica particles in the desired size range.

Poster 26

Presenter: Elvelyn Fernandez (Georgetown University)
Mentor: Alana Welm (Oncological Sciences)
Assessing Tertiary Lymphoid Structures in Mouse Mammary Metastasis Models to Predict Immunotherapy Efficacy

Metastasis is the leading cause of death in nearly all cancer types. Immunotherapy emerged as a new era of cancer treatment, however, a majority of patients do not respond to the therapy. One feature known for immunotherapy resistance is the lack of lymphocyte infiltration, by which lymphocytes, especially tumor-fighting cytotoxic T lymphocytes (CTLs), are absent in the tumor area. Strategies to improve lymphocyte infiltration or understand how cancer cells compromise the immune system would advance our knowledge to further improve treatment efficacy. The receptor tyrosine kinase Ron has been shown to promote metastasis by suppressing CTL activity. Pharmaceutical or genetic depletion of Ron restores the antitumor response. Tertiary lymphoid structures (TLS) are sites that generate and regulate antitumor defenses implemented by immune cells such as T lymphocytes, B lymphocytes, and dendritic cells. Formation of TLS has been shown in several cancer types and correlates to the increased presence of intratumor immune cells. We hypothesized that the presence of TLS could potentially lead to more favorable antitumor responses following Ron inhibition. Using our mouse mammary metastasis model, breast cancer cells were injected intravenously into wild type and Ron knock-out (TK) mice. Tumors from mouse lungs, a metastatic site for breast cancer, are being assessed for the presence of TLS. Through immunohistochemistry, TLS presence is assessed by staining for T and B lymphocytes in paraffin sections of lung metastases. We expect TK mice with the presence of TLS to have greater levels of an antitumor response.

Poster 27

Presenter: Kaylynn Gonzalez (Westminster College)
Mentor: Macy Barrios (Population Health Sciences)
ORIEN Avatar

Scientists across the globe are fervently working to advance cancer research and find better ways to treat, prevent, and understand cancer. The Oncology Research Information Exchange Network (ORIEN) is a network of 19 cancer centers that use a common protocol to share data and collaborate current cancer research. The Avatar project, a subsection of ORIEN, uses whole exome sequencing to identify possible disease biomarkers in a person's DNA. Patients who consent to this project allow researchers to use their samples and to follow them throughout their lifetime, in order to gain a better understanding of how certain cancers and treatments work. The purpose of ORIEN Avatar is to give researchers access to molecular data from thousands of patients; therefore, allowing them to easily and effectively study the disease, ask new questions, and collaborate research projects. The methods I used in the Avatar project consisted mainly of sample storage and retrieval, specimen processing within the pathology and histology departments, and shipment preparation and packing. For future research purposes, the goal of the Avatar project will be used to provide patients with better prognosis and match them with ideal treatment plans, with aims to pair patients with clinical trials based on their molecular profile.

Poster 28

Presenter: Katherine Morelli (McGill University)
Mentor: Chelsea Herdman (Human Genetics)
Identifying a role for the microRNA 24 family in zebrafish heart development

MicroRNAs (miRNAs) were discovered 25 years ago as a new class of small regulatory RNA molecules. In their mature form, microRNAs are about 22 nucleotides in length and are taken up by RISC complexes to induce repression of target genes by base-pairing with complementary sequences in target gene messenger RNA (mRNA). Many roles for these inhibitory non-coding RNAs have been identified since their discovery. More recently, microRNAs have been recognized in their capacity as regulators of human heart development and markers of heart disease. Previous work in the Yost lab identified the miR-24 family, homologous to the single miR-24 locus in humans, as showing significant dynamic changes in expression in the zebrafish heart throughout development. Additionally, the Nicoli lab at Princeton found that miR-24 family mutant zebrafish exhibit vasculature defects, however, the role for this miRNA family during heart development or angiogenesis was not investigated. In order to characterize the function of miR-24 in heart development, we obtained zebrafish with deletion alleles at all four miR-24 loci. Genotyping protocols using high-resolution melt analysis were first developed to identify quadruple mutant, heterozygous, and wild type fish. Subsequently, using immunofluorescent staining and whole-mount confocal microscopy, followed by quantitative image analysis, we have characterized major morphological aspects of the cardiac phenotype of miR-24 family knockout zebrafish at numerous developmental timepoints. This analysis not only determines when miR-24 family members act during development but also indicates cell types and processes that are affected in their absence. In addition, using the RNA sequencing data previously generated in the lab, predicted mRNA targets of the miR-24 family are being prioritized based on this phenotypic analysis, allowing for further functional characterization of the miR-24 family in heart development.

Poster 29

Presenter: Paula Aubrey (University of Idaho)
Mentor: Adam Hughes (Biochemistry)
Identification of Cellular Pathways to Combat Nutrient Toxicity: Regulation of Mitochondrial Protein Synthesis by Proteolysis

Amino Acids have diverse cellular functions including protein and metabolite biosynthesis, energy production, as well as cellular communication. An overabundance of amino acids in the cell can cause toxicity, a precursor for heart disease, aging, cancer, diabetes, and neurodegeneration. Likewise, toxic build-up of amino acids results in diseases such as Phenylketonuria (PKU), and Maple Syrup Urine Disease (MSUD). Thus far it has been identified that vacuole dysfunction leads to mitochondrial dysfunction. Additionally, through genetic screens we have discovered that proteases located in the mitochondria become essential under conditions that disrupt lysosome function. Proteases are important in mitochondrial protein quality control and function by degrading damaged proteins and regulating metabolic enzymes. The purpose of this study is to understand how the mitochondrial ribosome is regulated by mitochondrial protease and why this becomes required during loss of lysosome function. Defects in mitochondrial translation have been associated with numerous mitochondrial diseases and aging. At the culmination of this research we will have a better understanding of the regulation of the mitochondrial ribosome and why it is necessary to survive loss of lysosome function and combat nutrient toxicity.

Poster 30

Presenter: Tobin Wainer (University of Utah)
Mentor: Anil Seth (Physics & Astronomy)
Star Clusters in the Triangulum Galaxy

We construct a catalog of Star Clusters in the Triangulum Galaxy (M33). The catalog is the result of the Local Group Cluster Search (LGCS) citizen science project through Zooniverse, where users classify images from the Hubble Space Telescope (HST). Preliminary results show more than 1800 Star Clusters. We derive the completeness of the catalog from analyzing 1728 synthetic clusters to determine detection limits and by comparing our results to previous catalogs in the literature. From the use of weighting Zooniverse users based on how many objects they classified as star clusters that were in fact star clusters, we hope to improve the completeness of the catalog. The project continues to work with the catalog to derive ages and masses of the catalog objects from fitting the multi-band aperture photometry to models created by the Stochastically Lighting Up Galaxies (SLUG) code. The catalog expands upon previous ground based catalogs, providing base data for further research into star formation in M33.

Poster 31

Presenter: Evelyn Lauren (University of Utah)
Mentor: Man Hung (Orthopaedics)
Risk Modeling of Unmet Dental Needs using Machine Learning

Background: Oral health is a gateway to a person's overall health and well-being, however unmet dental care needs remain as a global public health concern. Previous studies have suggested that social determinants might be associated with unmet dental care needs, but there is a lack of study using large national data in this area. This study seeks to identify leading factors towards unmet dental care needs through the use of machine learning tree classifiers. Methods: Data were obtained from the household component of the 2016 Medical Expenditure Panel Survey. Sampling weights were applied to obtain demographic characteristics representative of the United States' population. Random Forest, ExtraTrees Classifier, Decision Tree Classifier, and Gradient Boosting Classifier were used to acquire the top predictors towards unmet dental care needs based on relative importance, and the results were compared with those examined using chi-square test and independent samples t-test. Results: The top predictors obtained were consistent across the different tree classifiers, except for Random Forest. Delayed in getting necessary medical care, family having problem paying medical bills, inability to get necessary medical care, family size, and total income were consistently rated as the top predictors of unmet dental care needs. All of the predictors are significant when chi-square test or independent samples t-test were applied. Conclusion: Social determinants are strongly related with unmet dental care needs. The use of machine learning tree classifiers provides the ability to process hundreds of variables at once and outputs the top variables based on order. Thus, it is possible to discover top predictors that were not previously found using traditional statistics. This study provides an opportunity for healthcare professionals and policy makers alike to identify populations in need of dental care more efficiently.

Poster 32

Presenter: Emmanul Lotubai (University of Utah)
Mentor: Yunshan Wang (Electrical and Computer Engineering)
UV Fluorescence Modification by Aluminum and Magnisium Bowtie Nano Structures

UV plasmonic nanostructures have applications in label free native fluorescence biosensing. Many aluminum nanostructures have been shown to modify emission properties of UV fluorescence molecules. However, these structures demonstrate small rate enhancement factors (less than 10x). In this paper, we report FDTD simulation results on excitation and emission enhancement factors of a pair of aluminum bowtie antenna in ultraviolet region. Our results show that the optimal geometry is a pair of small bowtie (radius 20nm) with apex angle 60 degrees. The highest radiative enhancement is 25x (340nm) and highest total decay rate enhancement is 70x, higher than previously studied geometries.

Poster 33

Presenter: Saxton Cruz (The College of William and Mary)
Mentor: Luisa Whittaker (Chemistry)
Investigation into Thin Film Interfaces through Lift off Method

Humans currently face environmental issues such as those caused by non-sustainable energy sources, namely the production of greenhouse gasses. One such avenue for combating these issues consists in the development of novel perovskite based solar cell devices. Perovskite based solar cells are a promising class of electronics as they are solution processed, unlike silicon based solar cells which require high energy input to be synthesized. My research consists in developing a synthetic approach to expose buried interfaces within such electronic devices. Currently there is a known technique used for organic thin films in which a semiconducting material can be delaminated or removed using PDMS,

from the surface with which it is overlaid. The aim of this research is to take this technique and apply it to inorganic-organic hybrid perovskite systems, as it is not well understood what happens at the interface of these many layered electronic devices. The successful exfoliation of the perovskite material was observed using water; however, it is well known that water degrades perovskites. Further studies will be required to elicit a better understanding of how different solvents interact with the perovskite layer, to thus achieve successful delamination without degradation.

Poster 34

Presenter: Celine Slam (University of Utah)
Mentor: Paul Sigala (Biochemistry)
Elucidating the Role of a Divergent Heme Oxygenase in Organelle Biogenesis in the Malaria Parasite

Malaria is a devastating disease with an estimated 500,000 deaths annually. Malaria is caused by single-cell, eukaryotic *Plasmodium* parasites that infect and grow inside human red blood cells. Parasites have developed many unique molecular adaptations to survive in the heme-rich environment of erythrocytes, with many unusual proteins of unknown function. We identified a divergent heme-oxygenase homolog (PfHO) in the *Plasmodium* genome that binds heme but has lost heme-oxygenase activity. PfHO is targeted to the parasite apicoplast, which is a chloroplast-like organelle with a small genome that houses core metabolic pathways. Prior data shows that PfHO binds DNA in a heme-dependent manner and is essential for transcribing the apicoplast genome into RNA. We hypothesize that the essential function of PfHO is to bind apicoplast DNA and recruit RNA polymerase to initiate transcription. We propose that PfHO binds heme that accumulates due to parasite digestion of hemoglobin, causing PfHO to dissociate from DNA and thereby turn off apicoplast transcription in mature parasites. To test this model, we are using *E. coli* bacteria to express and purify wildtype PfHO and mutant variants expected to alter heme-binding affinity and thus modulate DNA affinity. We will test the effects of these mutations using *in vitro* heme and DNA-binding assays. We will then express these PfHO variants in parasites to test if they rescue lethal knock-down of endogenous PfHO. These studies will test the importance of heme-binding for PfHO's essential function and thereby unravel a critical feature of its non-canonical role in apicoplast genome transcription.

Poster 35

Presenter: Rachel Sousa (Oregon State University)
Mentor: Fred Adler (School of Biological Sciences)
Modeling Cancer Cell Plasticity To Understand Induced Resistance

Cancer therapeutic resistance can arise through both the evolution and selection of genetic differences that improve fitness and by inducible phenotypic changes. In the latter case, therapy stimulates developmental changes that reduce drug sensitivity. It is necessary to consider both processes when finding effective treatments that prevent the emergence of resistant tumors. To understand how genetic and inducible resistance phenotypes influence cancer population growth, we are developing ecologically inspired mathematical models of the growth of cell cultures of sensitive and resistant cell lines. These models aim to capture the phenotypic plasticity of cancer cells as well as interactions between the different cells. Our goal is to understand how to slow, prevent, and/or reverse the emergence of resistant cancer cells. Here, we address the role of rapid, inducible plasticity in drug resistance.

Poster 36

Presenter: Claudia Charles (Utah Valley University)
Mentor: Jared Rutter (Biochemistry)
Computational Approaches to Elucidating Cancer Metabolism Remodeling

In cancer metabolism, malignant cells arise from an array of mutational changes to the cells' genetic make-up. Most often, the most mutated genes are those within the regulator, in turn, manipulating a cell's metabolism. Cancer metabolism is a complex system, and as such, a more systematic understanding of this reprogramming's effect on tumorigenicity is lacking. By developing and utilizing computational approaches in cancer metabolism, we can further understand which enzymes, metabolite transporters, kinases, transcription factors, etc. are associated with each other and how these relationships change between normal and cancerous tissue on a patient-to-patient or population basis. Through data consortia like The Cancer Genome Atlas (TCGA) program and Genotype Tissue Expression (GTEX), we determined key up- and down-regulated genes related to the tricarboxylic acid cycle (TCA) in colorectal, liver, and prostate cancers. Noticing that alpha-ketoglutarate dehydrogenase is down-regulated in two of the three cancers described, we investigated the variability of genes related to glutamine/glutamate homeostasis between these cancers and their impact on patient survival. By understanding the differential mechanisms cancer cells utilize to alter a cell's usage of nutrients, new possibilities for more preventative or personalized therapeutic methods might become available.

Poster 37

Presenter: Estephani TorresVillanueva (University of Utah)
Mentor: Anil Seth (Physics & Astronomy)
Local Group Cluster Search - Triangulum Galaxy (M33)

We employ image classifications done by citizen scientists through the Zooniverse Local Group Cluster Search (LGCS) project to construct a more robust and complete star cluster catalog based on *Hubble Space Telescope* (HST) data of the Triangulum Galaxy (M33). With over 1800 star clusters already detected from previous cluster search projects, we hope to expand the Triangulum Galaxy catalog by incorporating age and mass probability distribution functions and integrated light ages for each of these clusters. We are able to calculate the age and mass of our clusters from the measured photometry of our potential cluster images in 6 individual passbands that range from near-UV to near-IR using the high spatial resolution of the *Hubble Space Telescope's* Wide Field Camera 3 (WFC3) and Advanced Camera for Surveys (ACS). To enhance our measurements, we account for A_v extinction in our photometry by using a lognormal A_v distribution with a mean of 1. We limit our cluster mass function (CMF) to mass breakpoints of 100 – 100000 $M_\odot$ in order to encompass a more general portion of the stellar population which excludes stellar clusters with stars below 0.8 $M_\odot$ which have a negligible contribution to the integrated light of our measurements. We will also fit cataloged star clusters to the Kroupa initial mass function (IMF) and the Padova stellar track so as to maintain consistency with the previous Local Group Cluster Search done for the Andromeda Project (Johnson et al. 2015). Through the use of these stellar models, created by the Stochastically Lighting Up Galaxies (SLUG) code, we hope to enhance the completeness of the Local Group Cluster data for the Triangulum Galaxy (M33) and other local group galaxies like the Small and Large Magellanic Clouds.

Poster 38

Presenter: Jordan Little (Clemson University)
Mentor: Karen Eilbeck (Biomedical Informatics)
Variant curation for newborn screening genomic panels.

In the US, NBS was established as a public health initiative in the 1960s, with the goal of identifying infants with life threatening but treatable disorders before the onset of symptoms. This allows treatment to begin before clinical symptoms (i.e. permanent brain damage, growth retardation, sepsis, or severe anemia) or death can occur in the newborn. The Utah Department of Health is implementing exome sequencing for infants flagged by the initial test. Interpretation of genomic results is non-trivial, especially in cases where there are rare or novel variants in combination with metabolic data. There exist many databases that have over the years attempted to catalogue genetic variants associated with the many metabolic and immune disorders on the exome panel. Also a national database: ClinVar has become the hub for variant annotation by reference labs, and is a starting place for in depth curation activities. The team at UDoH needs to have a comprehensive set of all reported variants for each disorder to use in their interpretation pipeline. This project set out with the goal of finding and parsing all historical genomic variants for 542 genes, from 7 databases and converting them all to the same coordinate system for comparison. We have collected 20,310 variants, reduced to 14,017 non-redundant variants and compared to ClinVar annotations with and with assertion criteria for the list of 37 SCID genes. 29 of the 30 SCID genes that were analyzed had at least one variant that overlapped between ClinVar and the curated niche databases We have found that ClinVar is still the standard for annotated variants. When compared to the other databases; if ClinVar had less variants the niche datasets were lacking any annotation, making them difficult to use in a clinical setting and challenging the validity of the submission.

Poster 39

Presenter: Maggie Brueggemeyer (University of Utah)
Mentor: Matthew Kieber-Emmons (Chemistry)
Identification of the Photoactive Yellow Protein Partner Protein

Photoactive yellow protein (PYP) is a light sensing protein found in halophilic purple sulfur bacteria *Halorhodospira halophila*. PYP is a characteristic example of a Per-Arnt-Sim (PAS) domain, a highly conserved protein motif. PAS domains can be found in nearly every type of organism and exhibit various sensory and signaling functions. Although PYP is regarded as the structural prototype of the PAS domain, its partner protein involved in effecting the organism's response to blue light has not been identified. This project seeks to uncover the downstream partner protein of PYP. Discovery of the partner protein of PYP will enable definition of the mechanism of signaling by PYP and facilitate future studies of the mechanism and function of PYP and similar sensory proteins. Our approach employs a two-hybrid system to identify proteins that have significant interactions with PYP. This method involves fusing the proteins of interests to the two catalytic subunits of adenylate cyclase and determining the level of interactions between the proteins based on the

observation of cAMP production when the fused proteins are expressed in an adenylate cyclase deficient strain of *E. coli*. Recent results towards development of this two-hybrid system will be presented.

Poster 40

Presenter: Lily Anderson (Indiana University)
Mentor: Peter Armentrout (Chemistry)

Dissociation of Asparagine Cationized with Calcium: A Guided Ion Beam Study of [Ca(Asn-H)$^+$(Asn)]$_2$

The fundamental interactions of calcium binding with amino acids have been the focus of many experimental and theoretical studies because of the biological relevance of metal–amino acid binding in protein structure. Relative calcium–amino acid binding strengths have been previously evaluated using the kinetic method; however, it is of interest to more directly measure these values. Thus, the dissociation of asparagine (Asn) cationized with calcium (Ca^{2+}) was evaluated in this study. Here, dissociation of the experimentally formed [Ca(Asn-H)$^+$(Asn)]$_2$ complex was carried out using guided ion beam tandem mass spectrometry and found to eliminate one and two Asn molecules. Further evaluation using quantum chemical calculations have located a ground state [Ca(Asn-H)$^+$(Asn)]$_2$ conformer that exhibits exclusive coordination at oxygen sites and was determined to maintain this analogous coordination throughout the primary and secondary losses of Asn. The experimentally determined threshold energy for the primary loss of asparagine (172 ± 8 kJ/mol) was compared to theoretical reaction energies calculated at the B3LYP (123 kJ/mol), B3P86 (128 kJ/mol), and MP2 (138 kJ/mol) levels of theory. This discrepancy suggests that the lowest energy conformer of the complex has yet to be located computationally.

Poster 41

Presenter: Alexandra Acuna (University of Utah)
Mentor: Martin Tristani-Firouzi (Pediatrics)

NFATc1 As a Novel Atrial Fibrillation Susceptibility Gene

Atrial Fibrillation (AF) is the most common type of cardiac arrhythmia. It is a progressive disease that increases the risk of stroke, heart failure, and sudden death. Familial AF, where several family members are affected by young-onset (<40) AF, has a strong component of heritability. Using whole exome sequencing, we identified a novel mutation (M527L) in the Nuclear Factor of Activated T-Cells 1 gene (NFATc1) that segregates in an autosomal-dominant pattern within a family with a young-onset AF phenotype. To understand the mechanism responsible for the increased susceptibility to AF, we developed a homozygous mutant zebrafish line (Δ31) with a CRISPR/Cas9-induced 31bp deletion in exon 2 of the *nfatc1* gene, predicted to cause a premature stop codon truncating the nfatc1 protein. The Δ31 zebrafish develop atrial arrhythmias at 5-9 weeks (juvenile stage). NFATc1 is a transcription factor important in heart development and pathological hypertrophy, but not previously linked to arrhythmia. We hypothesize that NFATc1 loss of function will impact atria-specific gene expression leading to increased cardiac excitability that acts as the substrate for developing AF. To test this hypothesis, we will use Quantitative Polymerase Chain Reaction (qPCR) to study changes in ion channel gene expression in juvenile Δ31 and wild-type (WT) atria and ventricle. We expect some ion channel genes will be differentially expressed in Δ31 atria compared to WT. This information will provide insight into the mechanism by which NFATc1 contributes to AF in humans and may allow for more accurate treatment for Familial AF patients using precision medicine.

Poster 42

Presenter: Angel Griego (University of Utah)
Mentor: Sara Grineski (Sociology)

Social Vulnerability, Recovery Aid, and the Extent of Recovery: Results from a survey conducted after Hurricane Harvey in Greater Houston, Texas

Unequal distribution of recovery resources is a concern after major disasters in the United States. Environmental justice research has shown that socially vulnerable residents, such as families with small children, racial/ethnic minorities and the disabled, often experience disparate impacts from disasters. This study examines household-level social inequalities in receipt of aid and short-term recovery within four months after a devastating disaster, Hurricane Harvey. Harvey made landfall along the Texas Gulf Coast area in August 2017, causing unprecedented rainfall, flash flooding and winds. Our research objectives are to (1) analyze the relationship between social vulnerability variables and receipt of recovery aid from any source, and specifically from government or non-government organizational (NGO) sources; and (2) examine how social vulnerability and the receipt of aid influenced the extent of near-term household recovery. Data come from a 2017 survey of a random sample of Greater Houston households conducted within four months of Harvey. Generalized linear models were used to analyze data from 310 households who were affected by Harvey. Among other results,

households with greater levels of home damage ($p<0.001$) and US-born Hispanics (compared to non-Hispanic whites, $p<0.01$) were more likely to have received aid from any source. The presence of children in the household increased the likelihood that the household received specifically government aid by 161% ($p<0.01$). Non-Hispanic blacks were 142% more likely ($p<0.05$) to have received NGO aid than non-Hispanic whites, and those exhibiting greater post-traumatic stress (PTS) ($p<0.01$) had higher odds of receiving NGO aid as well. Receiving aid was not associated with more complete household recovery, but less home damage ($p<0.001$), less PTS ($p<0.001$), and higher income ($p<0.01$) were associated with more complete near-term recovery. These results can inform the actions of those seeking to provide recovery aid so that it more effectively serves the post-disaster needs of socially vulnerable people.

Poster 43

Presenter: Kristen Woody (University of New Mexico)
Mentor: Martin McMahon (Dermatology)
Elucidating the Role of Integrin Beta 3 in Metastatic Melanoma Progression

Melanoma is classified as a skin cancer derived from melanocytes. According to the American Cancer Society, 77% of patients will succumb to metastatic melanoma within five years of diagnosis. $BRAF^{V600E}$ is a constitutively activating mutation found in numerous cancers, especially cutaneous melanoma. Due to this mutation, the Mitogen-Activated Protein Kinase (MAPK) pathway is constitutively activated. The MAPK pathway regulates various cellular processes including cell motility. Cell motility is controlled by transmembrane, heterodimer receptors called integrins. Integrins are involved in nearly every step of cancer progression from a primary tumor growth to metastasis. In our research, we question the function of integrin β3 (*Itgb3*) in the progression of metastatic melanoma. Due to a strong correlation between integrin expression and metastatic phenotypes, we hypothesize that the knockout of *Itgb3* will result in less metastasis, slower migration, same proliferation, and no difference in survival. To test our hypothesis, we use mouse-derived cell lines with the $BRAF^{V600E}$ mutation to monitor the role of *Itgb3* in melanoma progression. Using CRISPR Cas9, we genetically ablated *Itgb3* expression to measure for invasion, migration, and survival *in vitro*. After completing the functional assays and validation of the knockout, we will, *in-vivo*, observe the metastatic rates. We will transduce the cell lines with luciferase-eGFP, and transplant them into mice and monitor for metastatic spread via bioluminescence imaging.

Poster 44

Presenter: Dane Gollero (University of Utah)
Mentor: Pearl Sandick (Physics & Astronomy)
Distinguishing Dark Matter: A Photon Story

Throughout our universe something strange is afoot. Of all the matter present only a fraction is what makes up you and I, the rest remains invisible. If a new type of particle is responsible then measuring its properties tells us which, (if any) of our theories is correct. This is where our story begins. Previous work on one of these models, so-called Dynamical Dark Matter (DDM), revealed how multiple dark matter particles can annihilate or decay into photons, which could be observed by future telescopes. Therefore we ask the question: From spectral signatures, how likely is it that it came from an ensemble of DDM particles, if so, how much can we deduce about the original ensemble properties such as mass, number of particles, etc. To answer these questions I wrote software to simulate DDM-specific data to identify distinguishable spectral features and learn if we can connect them to specific dark matter models.

Poster 45

Presenter: Shalini Kasera (University of Utah)
Mentor: Lisa Joss-Moore (Pediatrics)
IUGR and development alter hepatic PEMT levels in the rat

Intrauterine growth restriction (IUGR) is a phenomenon in which the fetus fails to achieve its genetic growth potential *in-utero*. IUGR dysregulates circulating docosahexaenoic acid (DHA), an ω-3 fatty acid essential for organogenesis and favorable neonatal outcomes. This can lead to metabolic issues, such as lipid accumulation in the liver. Our group showed, in a rat model, that IUGR induces sex-divergent outcomes, with increased liver lipid accumulation in juvenile males and successful clearing of excess liver lipid in juvenile females. We also showed that DHA supplementation reduces hepatic lipids in male juvenile IUGR rats. The phosphotidylethanolamine methyltransferase (PEMT) phospholipid methylation pathway governs the export of lipids from the liver in the form of very low density lipoproteins (VLDL). Higher hepatic lipid concentration is thus associated with lower PEMT activity. We hypothesize that IUGR reduces PEMT expression in male rats and alters the temporal expression of PEMT in the liver. We also hypothesize that DHA supplementation normalizes hepatic PEMT levels. To test our hypothesis, we measured mRNA and protein

levels of liver PEMT in juvenile control and IUGR rats. In order to identify developmental timepoints critical for PEMT expression, we also measured PEMT mRNA throughout development in control rats. mRNA levels were measured using real-time RT PCR, relative to HPRT. In juvenile rats, IUGR increased PEMT mRNA and protein in the liver of female rats, but did not affect PEMT levels in liver of male rats. DHA supplementation normalized female hepatic PEMT mRNA levels. Assessment of liver PEMT mRNA levels from younger rats (day 0, 7, 14, and 21) showed that PEMT mRNA appears to peak at day 14. We conclude that IUGR induces altered hepatic PEMT expression in female rats, which is normalized with DHA. We speculate that increased PEMT in female IUGR liver leads to increased hepatic lipid clearance. Ongoing studies are evaluating the effect of IUGR on PEMT and hepatic lipids at earlier developmental timepoints.

Poster 46

Presenter: Greta Weiser (University of Utah)
Mentor: Jennifer Follstad Shah (Sociology)

Efficacy of Urban Habitat Weed Pull Programs on Management of Myrtle Spurge (Euphorbia myrsinites) in the Foothills of Salt Lake City

Myrtle Spurge (*Euphorbia myrsinites*), is a noxious and invasive plant species that poses a threat to human health and undermines the diversity of the environment. This weed has been listed as a noxious species in Salt Lake County due to its caustic sap that causes blisters if it comes into contact with skin. Urban Habitat, a local volunteer weed pull program developed in 2013 by Neal Dombrowski, is collaborating with Red Butte Garden, the Natural History Museum of Utah, and the Salt Lake County Weed Control Program to physically remove myrtle spurge that has formed in patches along the Wasatch Foothills. Every Spring, Urban Habitat works with volunteers to physically remove invasive plant species in the Salt Lake County wildland-urban interface in order to control the population. Although a monitoring plan has been set in place as of 2016, the regeneration success of myrtle spurge and the effectiveness of this weed pull program is unknown. This research evaluates the effectiveness of Urban Habitat's myrtle spurge removal efforts from 2016-2019, using point intercept transect surveys and quadrat analysis to determine the frequency of myrtle spurge and species richness in a controlled area. For Urban Habitat sites 1 & 2, two sets of surveys were completed in spring 2017 and 2018 by researcher Brianna Milot. My research is a continuation of Milot's efforts to monitor the abundance and frequency of myrtle spurge regeneration in the foothills with the addition of analyzing species richness. I conducted surveys across all Urban Habitat research sites, including two additional research sites I developed in Dry Gulch Canyon. I was able to compare data across multiple locations in the Salt Lake County wildland-urban interface and provide an assessment of Urban Habitat's volunteer weed removal program over the past three years.

Poster 47

Presenter: Bryan Banuelos (University of Utah)
Mentor: Ming Hammond (Chemistry)

Variant HD-GYP enzymes selectively degrade 3',3'-cGAMP in bacteria

3',3'cyclic GMP-AMP (cGAMP), also known as bacterial cGAMP, is a recently discovered cyclic dinucleotide (CDN). CDNs are a class of second messenger molecules that regulate different bacterial lifestyle changes. cGAMP was first discovered to be involved with pathogenicity in *Vibrio cholerae* and has since been shown to play diverse roles in other species of bacteria, including the regulation of osmotic stress in *Myxococcus xanthus* and metal reduction in *Geobacter sulfurreducens*. Bacterial cGAMP is produced by GMP-AMP cyclases in response to environmental stimuli and degraded by phosphodiesterases (PDEs) to regulate cellular levels. Previous work conducted by the Hammond Lab revealed a new class of cGAMP-specific phosphodiesterases (GAPs), which possess an HD-GYP domain and an RxxQ/N motif to confer cGAMP selectivity over other CDNs. Our current research focuses on using phylogenetic analysis to find GAPs in other bacterial species and elucidate new cGAMP signaling pathways. In this study, we chose to focus on GAP candidates from four different bacterial species: *Clostridium botulinum*, *Magnetospirillum gryphiswaldense*, *Paenibacillus polymyxa*, and *Pseudomonas aeruginosa*. We used *in vivo* biosensor assays to test these candidate proteins for cGAMP-selective degradation in live *E. coli* cells after protein expression. These proteins were also purified and characterized *in vitro* using LC/MS analysis. Overall, these experiments will help us better understand the life cycle of the 3',3'-cGAMP signaling molecule, while laying grounds for future work in the characterization and manipulation of the different ways in which bacteria respond to their environment.

Poster 48

Presenter: Dylan Neff (University of Utah)
Mentor: Elisabeth Conradt (Psychology)

The Intergenerational Effects of Maternal Anxiety During Pregnancy

Prenatal programming theory predicts that maternal stress during pregnancy increases the likelihood that infants will exhibit altered behaviors and emotions after birth (O'Connor et al., 2002), which may be adaptive for a stressful environment. Additional research (Glover, 2015) has shown that there is reason to suspect that maternal psychobiological

factors can have wide-ranging effects on infant development. One way to measure those effects is to observe physiological arousal during stress. Electrodermal activity, a measure of the sympathetic nervous system, has also been widely used as an indicator of emotion arousal in adults and children. For this study, mothers completed a battery of questionnaires during their third trimester of pregnancy that included the State-Trait Anxiety Inventory. They returned to the lab with their infants seven months postpartum, and participated in the Still-Face Paradigm. During this task, mothers played with their infants for two minutes, then stopped interacting and maintained a flat affect for two minutes, then finally resumed normal play. This short period of parental unavailability allows researchers to observe infants' regulatory ability. Using data from this experiment, it was hypothesized that high levels of prenatal maternal anxiety would firstly be related to high infant baseline sympathetic system arousal, and secondly be related to high infant sympathetic reactivity to stress. Using linear regression, the author found that mothers with higher trait (general) anxiety during the third trimester of pregnancy had infants who were less reactive to the stressor($\beta = -.26$, $p < .05$). Infant sex, household income, and maternal race and age were included in the regression as control variables. Baseline reactivity was not significantly related to maternal anxiety. While neither hypothesis was supported, the finding that prenatal maternal anxiety is significantly related to infants' postnatal physiological reactivity lends support to the theory that in utero experiences may "program" infant stress response systems.

Poster 49

Presenter: Emilia Roberts (University of Utah)
Mentor: Leissa Roberts (Nursing)
Identifying Key Factors and Characteristics of Patients Disappearing from Prenatal Care

Background: Prenatal care, while essential to the wellbeing of the mother and baby, is often underutilized. The purpose of this study was to identify characteristics associated more commonly with women who engaged in prenatal care with BirthCare HealthCare (BCHC), yet did not complete care with the practice. Methods: This retrospective study included 1358 woman who completed at least one new obstetrical visit with BCHC between July 1, 2015 and June 30, 2017. Of the 1358, 421 women did not deliver with the BCHC. Using the University of Utah's medical records, and with IRB approval, demographic information (age, ethnicity, marital status, address and primary language spoken) as well as pregnancy information (gestational age, missed and attended prenatal visits and pregnancy outcome) was documented. Results: Of the 421 patients in this study who did not deliver with BCHC the following reasons were identified; insurance change (16), external transfer (75), referred (131), miscarriage (64), disappeared (89), moved out of state (22), C-section (18). Mitigatable losses were identified as women categorized as transfer to external and disappeared. Women who transferred to external were 79% Non-Hispanic White, 61% Married, 95% English Speaking and left care at an average gestational age of 26.5 weeks. Women who disappeared from care were 67% Non-Hispanic White, 60% Married, 90% English Speaking and left care at an average gestational age of 18 weeks. Conclusions: There are numerous reasons women enter prenatal care and do not follow through to delivery with the same provider. With initial data analysis it does not appear that identifying age, ethnicity, primary language spoken and gestational age will allow providers to identify women who are at risk of not completing prenatal care or not delivering within the practice. Further analysis is needed to determine if any factors are significant or can be mitigated.

Poster 50

Presenter: Ryan Murdock (University of Utah)
Mentor: Taylor Sparks (Materials Science and Engineering)
Is chemical domain knowledge even necessary when machine learning materials properties?

The process of predicting material properties using machine learning often involves engineering a description of the materials being assessed, which is then used as input to various models for regression or classification. This description commonly comes in the form of a list of easily-measured characteristics of elements in the material. For instance, one might include the boiling point, atomic radius, and electronegativity of each element within a particular chemical formula. Creation of such composition-based feature vectors (CBFVs) can be time-intensive and requires significant domain knowledge. The advent of learned elemental embeddings and elemental encodings created with no explicit knowledge of chemistry challenges the practice of utilizing and creating CBFVs. Further, it raises questions concerning the necessity of domain knowledge for the practice of material informatics. This work assesses the efficacy of CBFVs and chemistry-free representations given different predicted properties and dataset sizes in order to compare these two approaches. We find that the simple one-hot encoding of elements performs competitively with other representations under some circumstances. For instance, preliminary results indicate that using one-hot encoding with a simple model and a large dataset may reduce the mean absolute error (MAE) of predicting shear modulus by 2.5% when compared to Mat2Vec, a learned embedding. Further, these preliminary results indicate a potential 9.5% decrease in MAE with one-hot on predicting formation energy when compared to Magpie, a CBFV.

Poster 51

Presenter: Tyrell Natewa (University of New Mexico)
Mentor: Jennifer Doherty (Population Health Sciences)
Exploring Breast Cancer Incidence Among Pacific Islander Women in Utah

Data for Asians and Pacific Islanders (PIs) are typically combined in cancer statistics. However, the incidence of breast cancer in Asians has been reported to be lower than that in PIs. Also, breast cancer risk factors and disparities in access to healthcare may vary between Asians and PIs. We examined Utah state age-adjusted incidence rates of breast cancer by race/ethnicity, separating Asians and PIs, and prevalence of selected breast cancer risk factors. Using state-wide cancer data from Utah's Public Health Indicator Based Information System (IBIS) from 2005-2015, we observed that PIs had the highest age-adjusted incidence of breast cancer at 145 per 100,000 (95% confidence interval (CI): 114-182), followed by Non-Hispanic Whites (NHW) at 117 (95% CI: 115-119). Asians had the lowest incidence at 84 (95% CI: 74-95). PIs also had the highest breast cancer mortality rates at 44 per 100,000 (95% CI: 28-66), followed by NHW at 22 (95% CI: 21-23). Asians had the lowest mortality at 11 (95% CI: 7-16). Using Behavioral Risk Factor Surveillance System (BRFSS) data on Utah women collected between 2009-2015, we observed that PIs had the highest age-adjusted prevalence of obesity at 50% (95% CI: 41-59) followed by African Americans at 35% (95% CI: 28-44), NHW at 24% (95% CI: 23-24), and Asians at 7% (95% CI: 5-11). Further research is needed to identify factors associated with the strikingly high breast cancer incidence and mortality rates in the Utah PI population in order to develop prevention strategies tailored to this population.

Poster 52

Presenter: Kent Wilson (Benedictine College)
Mentor: John Matthews (Physics & Astronomy)
FLUKA Simulation of sFLASH Experiment

When a high-energy cosmic ray strikes Earth's atmosphere, it creates a shower of energetic particles known as an "extensive air shower." This shower deposits energy and excites air molecules, which then de-excite and release "fluorescence" light. Collaborations such as Telescope Array (TA) observe this light and attempt to reconstruct the properties of the incident primary particle. To determine the energy of the incident cosmic ray, the fluorescence yield of air must be known. Fluorescence yield is a measure of how much light is released for a given amount of energy deposited in air. To measure this quantity precisely, particle accelerator experiments such as the Super Fluorescence Air Shower (sFLASH) experiment are conducted. In the sFLASH experiment, an electron beam collides with a target to create air showers similar to those produced by cosmic rays. In this work, FLUKA was used to simulate the sFLASH experiment so that the energy deposition of the secondary particles could be calculated. The energy deposition of sFLASH, calculated by FLUKA, was found to be within 3% of the energy deposition calculated by Geant4, an alternative simulation method carried out by an independent team. The energy deposition of different targets was also simulated, yielding insight into how the energy deposition changes with different target thicknesses. This work will allow for a precise measurement of the air fluorescence yield, which will reduce the systematic uncertainty in the calculation of the energies of primary cosmic rays.

Poster 53

Presenter: Makenna Terrell (University of Utah)
Mentor: Lauri Linder (Nursing)
Adolescents and Young Adults With Cancer: An Analysis of Priority Symptoms

Adolescents and young adults (AYAs) with cancer are a patient population that is
oftentimes overlooked. This study analyzed priority symptoms reported by AYAs at two clinical visits prior to receiving chemotherapy using a heuristics-based symptom assessment tool, the Computerized Symptom Capture Tool (C-SCAT). Data were derived from a larger single group, longitudinal, mixed methods study conducted by my mentor, Dr. Linder, and her multi-site team to examine the effects using the C-SCAT with AYAs at two clinical visits for chemotherapy. Participants were 15-29 years of age (median 19 years). At the first visit, the most frequently reported symptoms were nausea (n=13), lack of energy (n=9), lack of appetite (n=6), hair loss (n=6), and feeling drowsy (n=6). At the second visit, the most frequently reported symptoms were difficulty sleeping (n=10), lack of energy (n=10), pain (n=9), feeling irritable (n=5), and nausea (n=5). Participants provided 66 responses for the cause of the priority symptoms which were organized into six categories: Chemo/Treatment (n=44), Medications (n=7), Poor Sleeping (n=5), Psychosocial (n=6), Secondary Health Issues (n=7), and Don't Know (n=6). Participants provided 85 responses for why designating a priority symptom that were organized into two categories: Consequence (n= 61), and Characteristic (n=24). Participants provided 82 responses for what they did to alleviate symptoms. These were organized into 10 categories: Medications (n=30), Sleep/Rest (n=27), Distraction (n=2), Non-Medicinal Substance (n=8), Mindfulness (n=4), Appearance Management (n=4), Eating Strategies (n=8), Integrative Strategies (n=8), Physical Activity (n=3), and Nothing (n=3). AYAs most frequently attributed priority symptoms to their chemo or other aspects of their treatment. While medications were frequently used to alleviate symptoms, AYAs also reported using nonpharmacologic methods. Using the C-SCAT can help healthcare

providers better understand AYAs' cancer symptom experiences and support AYAs in managing their symptoms to improve quality of life.

Poster 54

Presenter: Eylul Yel (University of Utah)
Mentor: Marie Sarita Gaytán (Sociology)
Managing Authenticity in the Utah Craft Spirit Industry

The craft alcohol industry is booming throughout the country. The concept of "craft, " however, is interpreted differently by consumers as well as producers. Large brands and small companies alike promote their products as craft. This project explores how Utah craft spirit distillers distinguish themselves in an emerging market. Drawing on the content of website "About us" pages, social media posts, and structured interviews, initial findings suggest that for local distillers, "craft" is linked to notions of authenticity related to aspects of their personal backgrounds, the production process, the history of their company, and the places where they operate.

Poster 55

Presenter: Austin Cannon (University of Utah)
Mentor: Caroline Saouma (Chemistry)
Novel Ligand Synthesis for CO2 Hydrogenation

As the world continues to rely heavily on fossil fuel usage, it is imperative that new carbon sources be found. Ideally, CO_2 could be used as such a source. It is cheap and so abundant in the atmosphere that it contributes to global warming via greenhouse effect. Being able to mimic the carbon cycle as plants do, by using the CO_2 in the air as a carbon source, would be an extremely powerful tool. This would mitigate pollution, as it would allow us to control exactly what is in our fuel, affording cleaner combustion byproducts and help reach a net zero carbon footprint. Unfortunately, CO_2 is weakly electrophilic and unreactive, necessitating a catalyst for conversion to fine chemicals and fuel. Hydrogenation of CO_2 involves the addition of H_2 and breaking the carbonyl π bond. By adding variable amounts of electrons and protons to CO_2 it is possible to form methanol and formate. The work presented is focused on novel ligand scaffolds used for homogenous hydrogenations of CO_2 mediated by ruthenium. Homogenous catalysts are preferred due to the ability to analyze them in situ and tuning the catalyst by adjusting thermodynamic and kinetic properties. The studied ruthenium complexes have a pendant amine group in the second coordination sphere to assist in CO_2 binding stability during catalysis. Dimethylammonium dimethylcarbamate (DMC) is used as a soluble CO_2 surrogate in the hydrogenation reactions, as carbon capturing CO_2 with amine compounds has proven to be a useful tactic in removing CO_2 from the atmosphere. This project includes synthesis of two novel, Milstein-inspired, P-P-P ligands coordinated to ruthenium and preliminary thermodynamic and kinetic studies. A variety of techniques including single crystal X-ray diffraction, UV-Vis analysis, NMR, GCMS, and IC chromatography are used in the analysis of hydrogenation reactions and synthesis of the complexes. The work presented will be contextualized in terms of what parameters of the catalysts have significant effects on catalytic performance, allowing for rational design of next generation systems.

Poster 56

Presenter: Chelsea Li (University of Utah)
Mentor: Julio Facelli (Biomedical Informatics)
Understanding the Relationship between Protein Structure and Pathogenicity for PRNP Variants Associated with Creutzfeldt-Jakob Disease (CJD) and Gerstmann-Sträussler-Scheinker (GSS) Disease

PRNP is a gene coding for the major prion protein that is composed of 253 amino acids. This protein has a role in neuronal development and synaptic plasticity along with myelin sheath maintenance and homeostasis. Various mutations of PRNP can lead to genetic prion diseases, Creutzfeldt-Jakob disease (CJD) and Gerstmann-Sträussler-Scheinker (GSS) are two prion diseases that are the focus of this analysis. CJD patients develop rapid dementia with a short survival time, while GSS patients who may have similar symptoms have survival times that can last 3-10 years. To understand the role of mutations of these two clinically different neurodegenerative diseases protein structure prediction can be used to analyze how changes of the amino acid sequence affect structure. From Swiss Uniprot, the canonical sequence of PRNP was obtained. Using I-TASSER we predicted the 3D structures of PRNP for, both the canonical amino acid sequence and those obtained by single substitutions for each variant that have been reported to cause either CJD or GSS. The protein structures were compared to the wild-type structure and among themselves. Further investigation for this study will include using more tools to assess pathogenicity and deeper analysis and comparison between each of the variants along with seeing how the major prion protein interacts with other proteins to develop a potential pathway that it interacts. This

research was supported by a Supplement to the NLM Training grant T15 LM00712418, with additional support from the Utah Center for Clinical and Translational Science funded by NCATS award 1ULTR002538. Computer resources were provided by the University of Utah Center for High Performance Computing, which has been partially funded by the NIH Shared Instrumentation Grant 1S10OD02164401A1.

Poster 57

Presenter: Chris Nielson (University of Utah)
Mentor: Michael Morse (Chemistry)
Bonde Dissociation Energies of Late Transition Metal Sulfides

The bond dissociation energies (BDE) of late transition metal sulfides were studied using resonant two-photon ionization spectroscopy coupled with time of flight mass spectrometry. These molecules exhibit a quasi-continuous spectrum of vibronic states near their BDEs, allowing for the observation of a sharp drop in ion signal once the excitation energy exceeds that of the ground separated atom limit. The observed BDEs for FeS, CoS, NiS, RuS, RhS, OsS, IrS, and PtS are 3.240(3), 3.467(5), 3.651(3), 4.071(8), 3.611(3), 4.277(3), 4.110(3), and 4.144(8) eV, respectively. The methodology and results will be discussed.

Poster 58

Presenter: Tahno Warren (University of Utah)
Mentor: Scott Summers (Nutrition and Integrative Physiology)
A Role for Ceramides in Vascular Function

Cardiovascular complications are the leading causes of morbidity and mortality in individuals with obesity, type 2 diabetes mellitus (T2DM), and insulin resistance. Complications include pathologies specific to large (atherosclerosis, cardiomyopathy) and small (retinopathy, nephropathy, neuropathy) blood vessels. Common among all of these diseases is an altered vascular endothelial cell phenotype (i.e., endothelial cell dysfunction) that is characterized by reduced nitric oxide (NO) bioavailability. Understanding the mechanisms linking obesity and dyslipidemia to the impairment in endothelial function is essential for developing new therapeutic strategies to combat these debilitating disorders. The persistent exposure of blood vessels to elevated fatty acids and lipoproteins leads to the aberrant production of ceramides, a class of sphingolipids that inhibit NO production. Previous work has shown that pharmacological approaches that inhibit enzymes required for ceramide synthesis systemically prevent endothelial dysfunction, ameliorate hypertension, and lessen the development of atherosclerosis in rodents. These data strongly suggest that ceramides are important drivers of the endothelial dysfunction that underlies cardiovascular disease. To test the relevance of ceramides in endothelial function in vivo, we studied mice lacking Sptlc2, the rate-limiting enzyme in de novo ceramide synthesis, selectively within the endothelial cell using a tamoxifen-inducible knockout mouse model. Animals were maintained on a high-fat diet for 12 weeks. Animals were then administered tamoxifen and underwent a vascular function testing protocol. In line with the aforementioned studies, animals lacking Sptlc2 displayed improved endothelial dependent vascular flow mediated dilation (FMD). These data suggest ceramides affect vessel function in a cell-autonomous manner and reveal new therapeutic strategies for combating hypertension.

Poster 59

Presenter: Sophie Buysse (College of St. Benedict)
Mentor: William Anderegg (School of Biological Sciences)
Genetic Influence on Drought Tolerance in Quaking Aspen (Populus tremuloides)

Climate change poses a threat to quaking aspen (*Populus tremuloides)* in the southwestern U.S. as increases in temperature and decreases in precipitation are predicted to lead to more frequent, severe droughts. While some populations of quaking aspen tolerate drought, the extent of their tolerance has limitations which future environmental conditions may exceed. Quaking aspen are a clonal species, which provides an ideal system to study genetic contributions to drought-tolerance traits. By quantifying levels of drought tolerance from multiple trees within the same clone, the variability in how one clone responds to drought can be studied (i.e. phenotypic plasticity). By comparing drought-tolerance traits between nearby clones, genetic influences on drought tolerance can be detected. Phenotypic plasticity combined with genetic influences on drought-tolerance traits may allow certain clones to tolerate more severe drought than others. To investigate phenotypic plasticity and genetic influence on drought response in quaking aspen, we investigated the extent to which physiological drought-tolerance traits differ within ramets of a single clone and between clones across an elevation gradient in aspen forest stands in the San Juan National Forest in Colorado during a severe drought year (2018). The following drought-tolerance traits were measured: percent loss of stem hydraulic conductivity (PLC), leaf area-to-sapwood area ratio, specific leaf area, and water potential at leaf turgor loss point. These traits capture the level of drought stress on a tree (e.g. PLC) as well as ways for trees to physiologically respond to drought stress (e.g. decreasing leaf area-to-sapwood area). We observed variation in all drought-tolerance traits between ramets of the same clone. Variation was also observed between clones, though it could not be directly attributed to genetic influence. These results

indicate that while genetic influence may be a factor in drought-tolerance traits, factors such as environmental conditions likely play a larger role.

Poster 60

Presenter: Ashli Young (University of Utah)
Mentor: Sara Simonsen (Nursing)
Utah Women with Bleeding Disorders: Experiences with Pregnancy and Childbirth

Approximately 1% of women in the U.S. have a bleeding disorder (BD), yet many are not aware of their condition despite symptoms such as heavy menstrual bleeding. Women with BDs are more likely to experience heavy obstetrical bleeding compared to those without BDs. However, population-based data on pregnancy outcomes and contraceptive use in this population are lacking. This retrospective cohort study utilized linked birth and fetal death records and clinical billing data from University of Utah Health and Intermountain Healthcare. Utah residents who had their first live birth or stillbirth at >20 weeks gestation (2008-2015) and who received non-emergent care within either system prior to the birth were included (n=53,708). A total of 326 women had at least one record of a BD ICD-9 code in either system. Compared to the general population, women with BDs were more likely to have used a long-acting reversible contraceptive (LARC) prior to their first birth (7.4% vs 1.6%) but had similar rates of LARC after their first birth (10.4% vs 10.7%). The rates of small for gestational age infants were similar for women with and without BDs (12.6% vs. 10.1%, RR 1.25, 95% CI 0.94-1.67). However, the rates of preterm birth were significantly different (14.7% vs 7.5%, RR 1.97, 95% CI 1.52-2.56). Notably, all of the women with BDs who required a postpartum blood transfusion, had an unplanned postpartum hysterectomy, or were transferred to an intensive care unit were not diagnosed with a BD until the year of their child's birth. In conclusion, women with BDs had an increased risk for preterm birth and those without a diagnosis prior to their first birth were at risk for serious postpartum complications. Efforts to increase screening and diagnosis of BDs prior to pregnancy may help improve birth outcomes for these women.

Poster 61

Presenter: Braden Fallon (University of Utah)
Mentor: Melodie Weller (Dentistry)
Hormone-Mediated Regulation of Hepatitis Delta Antigen Expression in HEK 293 Cells

Persistent low-level infections of the Hepatitis Delta Virus (HDV) have been suggested to lead to the full development of primary Sjogren's syndrome (pSS). Primary Sjogren's syndrome is a chronic autoimmune disease characterized by decreased tear and/or saliva production, inflammation within salivary gland tissues and development of autoantibodies. Women are 9 times more likely to be diagnosed with pSS and are most often diagnosed during early-stage menopause where progesterone, estrogen and testosterone levels decrease. We hypothesize that differential hormone profiles associated with peri- or post-menopausal women may lead to increased HDV antigen expression and increased risk of pSS development. Therefore, a study was designed to identify whether changes in concentrations of these hormones affect the expression of the HDV antigen in an in-vitro system. HEK 293 cells expressing the small HDV antigen under control of a tetracycline-inducible promoter (HEK-293-SAG) were cultured in 96-well plates with media containing gradients of hormone concentrations within physiological constraints. Testosterone, progesterone, B-estradiol, and DHEA were selected as study hormones. HEK-293-SAG cells were incubated for 3 days +/- hormone exposure and +/- 0.1 ug/mL tetracycline to activate the tetracycline promoter. The cells were incubated under experimental conditions for 72 hours. At the termination of the study, RNA was isolated, and the antigen copy number was quantified via qPCR. An increased HDV transcript copy number indicates stimulation of antigen transcription while a decreased copy number indicates inhibition. Based on previous research, it is expected to observe an increase in HDV antigen transcripts with lower hormone concentrations. Further studies are warranted to validate the mechanism of hormone-mediated regulation of HDV antigen expression.

Poster 62

Presenter: Tyler Simons (St. Cloud State University)
Mentor: Vahe Bandarian (Chemistry)
Characterization of novel radical SAM RiPP maturases

The radical S-adenosyl-methionine (SAM) enzyme family utilize [4Fe-4S] clusters in the homolytic cleavage of SAM to form a 5'-deoxyadenosyl radical, which can perform otherwise difficult biochemical reactions. These enzymes are involved in antibiotic synthesis, post-transcriptional modification, and post-translational modification. Ribosomal encoded and post-translationally modified polypeptides (RiPPs) are emerging as an area of intense interest, as many radical SAM enzymes have been found to catalyze complex transformations on these peptides. This poster will detail biochemical studies on one of these enzymes.

Poster 63

Presenter: Stephen Harman (University of Utah)
Mentor: Samir Abdelrahman (Biomedical Informatics)
Temporal Risk Factor Analysis for Acute Kidney Injury

Acute kidney injury (AKI) is a condition frequently experienced by patients in intensive care units (ICUs) that is associated with increased morbidity and mortality. We defined AKI using the guidelines set by the Kidney Disease Improving Global Outcomes foundation's urine output criteria. Using the MIMIC-III data set, a freely accessible critical care database (Johnson AEW, Pollard TJ, Shen L, Lehman L, Feng M, Ghassemi M, Moody B, Szolovits P, Celi LA, and Mark RG. Scientific Data (2016). DOI: 10.1038/sdata.2016.35) we extracted data from 53,432 adult patients admitted in an intensive care unit. From this data, we derived 26 time series of variables that could be considered as predictive features. We conducted a risk factor analysis to understand how the significance of these features change over time. For each of the first twelve hours in which a patient was admitted into the intensive care unit, we used Chi-squared and Kruskal-Wallis H tests to determine the significance of these features with respect to the patients' stage of AKI within the next 6, 12, 24, 36, 48, and 72 hours. *This research was supported by a Supplement to the NLM Training grant T15 LM00712418. Computer resources were provided by the University of Utah Center for High Performance Computing, which has been partially funded by the NIH Shared Instrumentation Grant 1S10OD02164401A1.*

Poster 64

Presenter: Tanner Barton (University of Utah)
Mentor: Man Hung (Orthopaedics)
Deep Learning for Examination of Social Determinants of Health

Introduction: Today, there is an increased awareness regarding the importance of good oral health. Many studies have found a positive correlation between one's oral health, and their overall health status. As such, unmet oral health needs are of significant concern, and being able to predict them and take action could lead to an overall increase in societal health. This study aimed to predict unmet dental care needs from social determinants of health and other factors. Methods: Data from the household component (HC) of the 2016 Medical Expenditure Panel Survey were used for this study. Sample data were weighted and to represent the entire United States population. Deep learning methods were applied to the data to create a risk prediction model of unmet dental care needs. Results: The algorithms showed that the two most significant predictors of unmet dental care needs were age and personal income. Following these were total dental expenditures, and difficulties pertaining to paying medical bills. The algorithms were able to predict unmet dental care needs using various social determinants of health and other variables with an accuracy of 82.6%. Conclusion: It is important to be able to identify risk factors of unmet needs in order to improve one's health as a whole. The results of this study are useful towards educating public policy decisions, as well as helping society work to mitigate the number of people with unmet dental needs.

Poster 65

Presenter: Ivana Holiday (Fort Lewis College)
Mentor: Simon Fisher (Human Genetics)
Vitamin-E Treatment Reduces Hypoglycemia-induced Cardiac Arrhythmias in Diabetic Rats

For people with insulin treated diabetes, lowering blood glucose levels increases the risk of hypoglycemia. When hypoglycemia becomes severe, it can cause fatal cardiac arrhythmias. It is hypothesized that the increased oxidative stress, associated with the diabetic condition, makes the heart particularly susceptible to these fatal arrhythmias. The aim of these experiments were to determine if reducing oxidative stress with vitamin-E treatment would decrease the incidence of hypoglycemia-induced cardiac arrhythmias. To test this hypothesis, rats were made diabetic with streptozotocin (to model Type 1 diabetes) and were treated for 10 days with subcutaneous injections of either; 1) vitamin-E (400 mg/kg qod, n= 5) or 2) vehicle (as control, n= 8). Both groups of rats then underwent a hyperinsulinemic (400 $\mu U.kg^{-1}.min^{-1}$) hypoglycemic clamp (10-15 mg/dl) for 3 hours. Cardiac arrhythmias were monitored throughout the experiment with EKG electrodes. Mortality due to severe hypoglycemia was completely prevented with vitamin-E treatment compared to 25% mortality in the vehicle treated rats. Second degree heart block tended to be reduced in vitamin-E treated rats (0.7±0.5/min) compared to vehicle treated rats (2.4±1.1/min) but this did not reach significance. Third-degree heart block was noted in 40% of control rats but this was completely prevented in vitamin-E treated rats. This research demonstrates that treatment with the anti-oxidant vitamin-E reduces the heart's susceptibility to severe hypoglycemia-induced cardiac arrhythmias.

Poster 66

Presenter: Kobe Cornelison (University of Utah)
Mentor: Trafton Drew (Psychology)
Independent Component Analysis of Electroencephalography

Independent Component Analysis (ICA) is a novel analytical tool that can be used to reduce noise in non-gaussian data sets to extract normally distributed data. In lab we developed a new analysis protocol employing ICA for the purpose of analyzing Electroencephalography (EEG) data containing major muscle artifacts. Using this pipeline, we are able to generate more precise Event-related Potentials (ERP). This method is particularly useful in regards to EEG since data can often contain movement-based artifacts as well as random noise that are irrelevant to waveforms. ICA uses an algorithm to reduce the amount of noise in the raw data set by organizing the source electrodes into components that are then presented in order of the amount of variance the component contributes. By removing components that account for the highest amount of variance in the data, ICA is able to reduce the number of movement-related artifacts and overall noise in the data set. This is useful during the analytical process because by reducing variance across the data set we are better able to isolate the EEG component in the data that is associated with the task when creating ERPs. By creating more precise ERP waveforms we are better able to isolate the relevant components of the waveform that are associated with a task increasing the accuracy of the analysis.

Poster 67

Presenter: Alex Pehrson (University of Utah)
Mentor: Sara Simonsen (Nursing)
Provider Responses to the Implementation of One Key Question (r) into the University of Utah Healthcare System

Introduction: Unintended pregnancies account for almost half of all pregnancies in the United States and have important health and social consequences. One Key Question ®(OKQ) is an algorithm to aid healthcare providers in assessing a woman's pregnancy intentions. It asks the question, "Would you like to become pregnant in the next year?" and based on the patient's response, provides direction for follow-up contraceptive/preconception counseling. It has been recommended that the OKQ algorithm be used with every reproductive-age woman at every visit. This study was designed to identify barriers and facilitators to the use of OKQ among women's health care providers and medical assistants at University of Utah Health. Method: Interviews and surveys were conducted with 11 medical assistants, 7 obstetricians, 18 nurse midwives, and 10 women's health nurse practitioners. The interviews were audio-recorded and transcribed. Transcripts were coded to identify themes. Results: While many providers reported talking about pregnancy intentions with patients, this was not done or documented in a systemic way. There were different opinions about whether OKQ should be integrated into the electronic health record (EHR) and where it should go within the EHR. Study participants were motivated to engage in pregnancy intention screening and felt that OKQ would provide an important source of information about patients referred to providers within the health system who were not experts in women's health. Barriers to OKQ utilization included time constraints, disagreement about the frequency with which it should be utilized, and concerns about OKQ being inappropriate for some patients, such as those with infertility or a recent miscarriage. Conclusion: The implementation of OKQ into the University of Utah Health system would create a standardized tool for pregnancy intention screening and documentation. Other pregnancy intention screening tools should be considered as there were several concerns raised about the OKQ wording and proposed universal implementation.

Poster 68

Presenter: Rachel Kon (University of Utah)
Mentor: Ramkiran Gouripeddi (Biomedical Informatics)
Profiling Exhaled Breath Condensates in Exposomic Studies

It is well established that polluted air causes and exacerbates pulmonary disease such as chronic obstructive pulmonary disease (COPD), asthma, and sleep apnea. However, the biological mechanisms involved in these conditions is not well understood. The goal of this research is to identify biomarkers from exhaled breath condensate samples obtained from participants with these conditions, and trace biological pathways triggered by pollutants. These EBC samples which have been well preserved and catalogued are being analyzed using gas chromatography mass spectroscopy (GCMS) with solid phase microextraction (SPME) to identify various chemical signatures. Also, we collected air quality measurements for the time periods and geographic locations associated with these participants' residential locations and times of sample collection. The GCMS analysis results and environmental data are then integrated and assimilated to generate high-resolution spatio-temporal records of exposure and chemical signatures of biological mechanisms leveraging the Exposure Health Informatics Ecosystem (http://prisms.bmi.utah.edu/). We also will evaluate computational models of pollutant levels in this assimilation effort. Finally we will review any existing literature for those biomarkers that we find significant from our analysis for each of these respiratory conditions.

Poster 69

Presenter: Austin Hickey (University of Utah)
Mentor: Ryan Stolley (Chemistry)
Vinyl Cyanamide Synthesis and Their Utility in Intramolecular Hydroamination

Nitrogen Containing Heterocycles make up 51% of the small molecule drugs approved by the FDA in the past 10 years. Current synthetic approaches for N-Heterocycles are acceptable however, more efficient, enantiomer selective methods are desired. Cyanamides are a highly versatile tool in organic synthesis and especially cross coupling reactions. Vinyl-Cyanamides are a considerably underexplored area of chemistry that may further propagate the versatility of the cyanamide functional group. Utilizing various synthetic approaches, we are optimizing the synthesis of the vinyl-cyanamide substrates and testing various transition metal catalysts to explore the intramolecular cyclization products that occur. After screening the catalysts, we will then identify select catalysts that provide regio- and enantiomer selective products.

Poster 70

Presenter: Brendan Adams (Lewis and Clark College)
Mentor: Dollie LaJoie (School of Biological Sciences)
A system to decipher the role of Nup153 in nuclear assembly

The nucleus is an organelle essential for eukaryotic cell structure and function. It is encased by the nuclear envelope, a double lipid bilayer which houses a variety of protein components including nuclear pore complexes (NPCs). Nuclear pore complexes are intricate structures composed of proteins called nucleoporins. Nucleoporins, or Nups, are best known for mediating macromolecular transport across the nuclear envelope. However, Nups have several known and implicated functions beyond nucleocytoplasmic transport such as the DNA damage response, nuclear envelope breakdown and reformation during cell division, and correct and timely passage through cytokinetic abscission. Here we explore a novel role for Nup153 in nuclear envelope reformation during mitosis. Disrupting Nup153 function by depletion or dominant negative interference results in mistargeted nuclear envelope proteins, such as Lamin B2 and SUN1, during telophase. To better understand which features of Nup153 are essential for proper nuclear envelope formation, we focused on optimizing a system in which exogenous, mutant variants of Nup153 replace endogenous protein. The aim of this approach is to identify mutants that cause mistargeting of nuclear envelope proteins, in order to reveal the features of Nup153 required for nuclear envelope assembly. To use this assay to its full potential, it is necessary to attain a consistent and robust nuclear envelope phenotype following Nup153 depletion. Toward this end, this project focused on optimizing depletion conditions using the panel of cell lines developed for this approach. A variety of conditions were tested, tracking nuclear envelope proteins by immunofluorescence. While many aspects of the overall approach were validated, we experienced problems inducing a strong phenotype in certain cell lines. To overcome this barrier, new cell lines or a new expression system may be required.

Poster 71

Presenter: Matthew Lassey (University of New Mexico)
Mentor: Anne Blashcke (Pediatrics)
The role of variation in fibronectin binding proteins A and B in Staphylococcus aureus osteoarticular infection

Background: *Staphylococcus aureus* is a leading cause of serious bacterial infections in children and adults. A common manifestation of *S. aureus* disease is osteoarticular infection (OI). Fibronectin binding proteins A (*fnbA)* and B (*fnbB)* function as adhesins. Previous publications have looked at variation across *fnbA* and *fnbB*, Variation in fnbs may play a role in the propensity of certain *S. aureus* isolates for causing OI. We aim to determine if variations in *fnbA*/*B are associated with OI*. **Methods:** Invasive *S. aureus* isolates were collected from children 0-18 years treated at Primary Children's Hospital in Salt Lake City, Utah from 2009-2012. Medical records were reviewed to determine disease presentation. A multiplex PCR-based assay was adapted from published literature to determine presence of *fnbA* and *fnbB* using real-time PCR (qRT-PCR). A high-resolution melting qRT-PCR based assay was developed to interrogate a 3' deletion in *fnb*B. A qRT-PCR for *nuc* was adapted from published literature as a positive control. **Results:** We identified 357 patients with invasive *S. aureus* infections, of these 137 (38.4%) had OI and 66 (18.5%) had a central-line associated blood stream infection. 8 isolates were tested using the multiplex assay and displayed negative results for *fnbA* and *fnbB*. **Conclusion:** QRT-PCR can be used to evaluate both gene presence/absence and allelic variation in *S. aureus fnb*A and *fnb*B. Variation in these adhesins may contribute to the development of OI. Further testing will be done with additional OI isolates, we may also compare to isolates from CLABSI (central line associated blood stream infection) patients.

Poster 72

Presenter: Logan Edvalson (Brigham Young University)
Mentor: Micah Drummond (Physical Therapy and Athletic Training)
Neuromuscular Electrical Stimulation and Protein Supplementation During Bed Rest in Older Adults Increases Muscle Macrophages but Is Not Related to Preserved Lean Mass

Periods of inactivity in older adults due to injury or disease have shown to have negative effects on muscle strength. Therapies that mitigate these effects would reduce recovery time and allow patients to return to their lives sooner. Macrophage polarization states play a significant role in the repair and maintenance of muscle; one being proinflammatory (M1) and the another anti-inflammatory/pro-fibrotic (M2). Previously we found that neuromuscular electrical stimulation when combined with protein supplementation (NMES+PRO) preserved thigh lean mass in healthy older adults. Therefore, we hypothesized that induction of muscle macrophages by NMES+PRO may be partly responsible for maintenance of lean tissue. We analyzed muscle sections (CON, N=10; NMES+PRO, N=8) for macrophages and fibrosis before and after bed rest in both a CON and NMES+PRO groups. Analysis was quantified either by counting the number of macrophages per unit area in ImageJ or finding the percentage of section that was dyed (marker of fibrosis) using Nikon's image analysis software. Surprisingly, we found that the change in M1 macrophage was significantly higher ($p<0.05$) in the NMES group (vs control) after bed rest while M2 macrophages were unchanged. Moreover, the percentage of fibrosis trended upwards in the NMES group after bed rest ($p=0.06$). Neither Thigh lean mass nor fibrosis correlated with muscle macrophages. We conclude that daily treatment with NMES+PRO during bed rest induced a muscle pro-inflammatory response and tended to increase connective tissue deposition which might be a reflection of overuse (treatment: 3x day for 4 consecutive days) but was not related to the preservation of thigh lean mass that was observed previously.

Poster 73

Presenter: Paige Barta (Lewis & Clark College)
Mentor: Jared Rutter (Biochemistry)
Mitochondria Quality Control in Cancer

ATAD1 is an ATPase located on the outer membrane of the mitochondria. ATAD1 functions in protein quality control by removing mislocalized proteins from the mitochondrial outer membrane. This quality control system is important in reducing mitochondrial proteotoxic stress. There are many tumors that delete *ATAD1* by virtue of its proximity to the tumor suppressor gene, *PTEN*. Cancer types with this genomic deletion include prostate cancer and glioblastoma, which carry a dismal prognosis. We hypothesized that because ATAD1 plays a role in mitochondrial quality control, perhaps its absence generates novel liabilities in tumor cells. We are using biochemical and cell culture techniques to interrogate whether loss of ATAD1 confers vulnerabilities to tumors, which could represent new therapeutic targets.

Poster 74

Presenter: Desiree Quintana (Arizona State University)
Mentor: Rena D'Souza (Dentistry)
Studies On How High Levels Of BPA In Mothers Adversely Affect Enamel Formation In-Utero

Bisphenol A (BPA) is used worldwide in the production of polycarbonate plastics, epoxy resins, dental composite resins, food packaging and daily products. BPA affects multiple human organ systems as it acts as a disruptor of endocrine functions. Exposure to BPA during prenatal development has been shown to adversely affect deciduous dentition (baby teeth) and many permanent teeth. Since disturbances in enamel formation manifest as irreversible defects that are visible clinically, they provide a permanent record of exposures to BPA and other environmental toxins during pregnancy. The objective of our studies was to evaluate the current literature for reports on the effects of BPA exposure on enamel formation in rodents and humans. Exogenous delivery of BPA to pregnant and newborn rats resulted in enamel defects that correlated with the developmental of tooth development. Mandibular incisors from BPA treated-rats after 30 days exhibited hypomineralization similar to human MIH (Molar-Incisor Hypomineralization). Human teeth with MIH were compared with BPA-treated rat incisors, and both presented asymmetrical white enamel lesions. In comparison to control rats that showed completely normal dentition, over 75% of rats exposed to BPA showed enamel lesions. Comparing the results of human MIH teeth to the features of BPA-affected rat enamel, there are similarities between BPA-induced enamel defects in the rat model and human MIH lesions. In conclusion, rodents offer a valuable experimental model system to test the controlled exposure to BPA during prenatal development as enamel formation in rats closely mimics that seen in humans.

Poster 75

Presenter: Kiana Luu (University of Utah)
Mentor: J. David Symons (Nutrition and Integrative Physiology)
Whole-body inducible disruption of dihydroceramide desaturase: Vascular implications

Type 2 diabetes mellitus (T2DM) precipitates cardiovascular complications (e.g., impaired vision and atherosclerosis). These complications are associated with vascular dysfunction, which is a generic term to describe arteries that do not dilate or constrict appropriately. Gaining a thorough understanding of the mechanisms responsible for vascular dysfunction is requisite for the design and development of new therapeutic strategies to treat cardiovascular complications associated with T2DM. Our laboratory has shown that when vascular accumulation of the sphingolipid ceramide is *prevented* in mice, arterial dysfunction and hypertension that otherwise develop in response to high-fat (HF) feeding does not occur. Here, we tested the hypothesis that inhibiting ceramide biosynthesis in mice wherein ceramide has already accumulated *reverses* arterial dysfunction. Eight-week-old male mice consumed HF chow for 12 weeks. At 20 weeks of age, tamoxifen was administered (3 mg/day for 5 consecutive days via IP injection) to induce knockout (KO) of dihydroceramide desaturase (DES1), an enzyme responsible for ceramide biosynthesis. These mice were compared to a control group wherein DES1 was intact. A week after the last tamoxifen dose, mice were characterized metabolically through glucose and insulin tolerance tests. Then, the endothelial cells from carotid arteries were obtained to determine the efficacy of knockdown, and femoral and cerebral arteries were used to assess endothelial and vascular smooth muscle function on an isobaric myograph. Non-receptor mediated vasocontraction to potassium chloride, endothelium-dependent vasodilation to acetylcholine, endothelium-independent vasodilation to sodium nitroprusside, and intraluminal flow-mediated vasodilation to pressure gradients from 6-30 mmHg were not different when responses were compared in cerebral and/or femoral arteries between DES1 KO mice and the control group. Whole-body inducible KO of DES1 does not reverse vascular dysfunction that develops in mice wherein ceramide has already accumulated.

Poster 76

Presenter: Makenzie Hullinger (University of Utah)
Mentor: Bethany Buck-Koehntop (Chemistry)

Mechanistic interrogation of expression level-dependent roles of ZBTB38 on cell cycle promotion in prostate cancer

Prostate cancer (PCa) remains the most frequently diagnosed cancer in men, and like many cancers, aberrant alterations in DNA methylation patterns has been correlated with the disease condition. The ZBTB family of methyl-CpG binding proteins (MBPs), consisting of ZBTB33, ZBTB4 and ZBTB38, constitute a sub-family of transcription factors that selectively recognize methylated DNA sites. Upon methylated DNA recognition, these MBPs recruit enzyme complexes to remodel chromatin and modulate transcription. Our group has recently shown that ZBTB38 is up-regulated at the protein level in both PCa tumor tissue and cell line models, and has a notable connection to the transcriptional regulation of several proteins associated with cell cycle progression. Specifically, ZBTB38 depletion in an aggressive PCa cell line model induced significant accumulation in the G1-phase and decreased mRNA levels of key cyclin proteins, suggesting that it may function as a G1/S checkpoint regulator in these cells. To further mechanistically interrogate the role of ZBTB38 in cell cycle progression, we have determined that ZBTB38 protein levels vary with cell cycle phase. Future experiments will include determining whether ZBTB38 directly regulates transcription of the key G1-phase cyclin proteins. Combined, these studies will expand understanding for the mechanisms by which ZBTB38 transcriptional activities support the cancerous state in PCa.

Poster 77

Presenter: Thea Benally (University of New Mexico)
Mentor: Owen Chan (Internal Medicine)

Low Doses of Carvedilol Prevents Impairment of the Sympathoadrenal Response and Improves Hypoglycemia Awareness in Recurrently Hypoglycemic Diabetic Rats

Studies have shown that repeated activation of the adrenergic system during recurring episodes of hypoglycemia (RH) may contribute to the development of counterregulatory failure and loss of the ability to recognize subsequent episodes of hypoglycemia. We recently reported that treatment with low doses of the non-specific β-blocker, carvedilol, can prevent counterregulatory failure and improve hypoglycemia awareness in non-diabetic, RH rats. The current study investigated whether carvedilol can be used to prevent counterregulatory failure and improve hypoglycemia awareness in RH diabetic rats. For the first study, recurrently hypoglycemic streptozotocin (STZ)-diabetic rats were treated with carvedilol (4.5 or 6mg/kg, IP) or saline prior to undergoing a hypoglycemic clamp to assess the counterregulatory hormone responses. STZ-controls were also treated with saline. Compared to STZ-controls, RH reduced the epinephrine response by ~50% ($P=0.05$) and treatment with carvedilol restored the response to normal ($P<0.05$). To assess whether carvedilol can improve hypoglycemia awareness, diabetic rats made "hypoglycemia <u>un</u>aware" with repeated 2-deoxyglucose (2DG; 200mg/kg, SC) injections were treated with carvedilol for 1wk and food intake was measured in response to insulin-induced hypoglycemia as a surrogate marker for hypoglycemia awareness. Compared to STZ-controls, 2DG reduced food intake in response to hypoglycemia ($P<0.001$) and treatment with carvedilol increased food intake in 2DG rats ($P<0.05$). Our data suggests that low doses of carvedilol may be a useful insulin-adjunct therapy to help prevent counterregulatory failure and improve hypoglycemia awareness in Type 1 diabetic patients with impaired awareness of hypoglycemia.

Poster 78

Presenter: Saffron Collins (University of Utah)
Mentor: Claudia Geist (Sociology)
Examining the Perceived Hypothetical Impact of Pregnancy

Through data from HER Salt Lake, an longitudinal data collection initiative with Planned Parenthood and the University of Utah's Division of Family Planning, we have been looking at the reasons that individuals give for not wanting a pregnancy at this time in their life. Dr. Geist is specifically interested in the financial aspects of the issue. Through coding and analysis, we hope to get a better look at the perceived impacts of a hypothetical pregnancy.

Poster 79

Presenter: Sydney Cahoon (University of Utah)
Mentor: Melissa Seaboch (Anthropology)
Where the Primates Are

Primates do not make good pets because they are highly social animals that require members of their own species and large amounts of space to maintain positive psychological well-being. Additionally primates can also be hostile and display aggressive behaviors toward their owners, and they can transmit diseases (e.g. Salmonella, parasites, etc.) to their owners. Nonetheless, there are over 15,000 pet primates in the United States. Regulations for owning a primate vary from state to state from a complete ban to complete legality. The goal of this project is to understand the pet primate trade and ownership in the United States. Data were collected from 13 online exotic pet trade websites. Type of primate for sale, age, sex and location were recorded. This pilot study found that 154 primates were offered for sale in 15 states. Florida having the most primates for sale with 90 listings (60%) followed by Texas with 13 listings (8%). The number of primates for sale in Florida is surprising since Florida requires varying level of permits, while there are no regulations in Texas. The understanding of the primate pet trade in the United States is important because research shows that when primates are shown in non-naturalistic environments (e.g. outside of their natural habitat) incorrect assumptions are made about their conservation status and creates an increased desire to own a primate as a pet. Currently 63% of the 500+ primate species are endangered with the pet trade being an increasing threat. While it is assumed that primates for sale in the United States are captive-bred, these primates can, nonetheless impact wild populations because today's digital age, every primate kept in captivity is driving, either directly or indirectly, the extraction of primates in the wild.

Poster 80

Presenter: Henry Ponce-Orellana (University of Utah)
Mentor: Jill Shea (Chemical Engineering)
Rat Adipose-Derived Stem Cell Behavior on Fluoridated Hydroxyapatite Bone Substitutes

Introduction: Bone grafts are used to aid bone repair and regeneration in various surgeries ranging from dental implants to limb salvaging operations. Our group has been conducting research bone substitutes composed of hydroxyapatite and two fluoridated variants. These materials are representative of the various fluoridated forms of hydroxyapatite, which is a mineral found in bone and teeth. We have previously shown that both keratinocytes and osteoblasts adhere to and osteoblasts differentiate on our varying biomaterial surfaces. The goal of this project is to analyze cell proliferation and differentiation of rat adipose-derived stem cells (ADSC) on pellets made from fluorohydroxyapatite (FHA; Ca10[PO4]6FOH), fluorapatite (FA; Ca10[PO4]6F2), and hydroxyapatite (HA; Ca5[PO4]3OH). Methods: The powder for the pellets (FHA/FA/HA) was synthesized and sintered at either 1150 or 1250 degrees Celsius, which directly impacts the crystalline structure of the pellets. For the course of this study, the pellets and a control titanium disk (Ti) were plated with rat ADSC (1,316 cell/cm^2) and incubated for 2- or 10-days. Cell proliferation was measured via an Alamar Blue assay, with all data reported relative to titanium control. Cell proliferation was compared between the different materials using an ANOVA followed by a Tukey's post hoc test. Results/Conclusion: At two days post plating cell proliferation was statistically greater on the HA1150 pellets (156%±8%) compared all other surfaces (100± 10%; $p<0.05$). However at 10 days post plating the HA (142±25), FA (149±14), and FHA (141±17) sintered at 1250°C and FA (143±22) sintered at 1150°C had statistically greater cell proliferation compared to the titanium control (100±10%; $p<0.05$). While there was no difference between the FHA (121±2%) and HA (124±2%) 1150°C and titanium ($p>0.05$). Future work will evaluate number of cells adhered to the different surfaces, as well as protein (western blot) and gene expression markers (RT-PCR) linked to differentiation of cells to an osteoblasts lineage.

Poster 81

Presenter: Madeika Vercella (University of Utah)
Mentor: Caroline Saouma (Chemistry)

Electrochemical CO2 Reduction With the Use of Amines

Recently, greenhouse gases, such as CO2, have been a major concern for people globally. CO2 is the main contributor to climate change, as well as the earth's warming. Reducing CO2 is widely agreed to be effective in lessening the effects of climate change. Some common ways of reducing CO2 emissions include decreasing water usage and planting more trees, but these methods are not suitable for long-term reduction of CO2. For this reason, we are interested in developing scientific techniques that can improve our use of cleaner fuels, fuel-efficient vehicles, as well as energy and water-efficient appliances. Currently, most research pertaining to reducing CO2 involves sequestration, a process that consists of capturing CO2 and storing it underground. More specifically, CO2 is captured and compressed using chemical adsorbents such as amines that bind to CO2 either by physical or chemical force. Afterward, the CO2 is transported in pipelines, injected, and isolated in underground rock formations. These formations are usually at least a mile deep beneath the surface and contain porous rocks that hold the CO2. The CO2 is then trapped underneath impermeable non-porous layers of rock and is prevented from moving upwards. While this method does decrease the amount of atmospheric CO2, it is energy intensive, can cause fatality in the event of an earthquake, as well as desorption of CO2 from the adsorbents that also need high-temperature heating. An alternative strategy is to take the captured CO2 and directly convert it to fuels or fuel precursors. This approach is being investigated by the Saouma group. The laboratory's focus of research is significant because we bypass CO2 sequestration by using electrical energy to directly convert CO2-amine adducts to CO. CO can be combined with H2 to give alkanes, or fuels, via the Fischer-Tropshe process. Electrochemical reduction of CO2 is useful in that it uses electricity that can be derived from the sun and several products may form upon reduction of CO2.

POSTER SESSION II
10:30 AM – 12:00 PM

Poster 1
Presenter: Yotam Ardon (University of Utah)
Mentor: Caroline Saouma (Chemistry)
Kinetic Analysis of CO2 Hydrogenation with a Ruthenium Pincer Compound

Carbon dioxide (CO_2) is both a potent greenhouse gas and an appealing carbon feedstock for applications in alternative energy. Therefore, the development of catalysts for CO_2 hydrogenation—the transformation of CO_2 to formate and methanol—has environmental and industrial significance. While many competent catalysts have been developed, including Milstein's (^{tBu}PNP)Ru catalyst, little attention has been paid to the kinetics of CO_2 hydrogenation. Kinetic studies are capable of revealing the underlying mechanism of a catalyst, and importantly, preliminary studies demonstrate that (^{tBu}PNP)Ru can form formate through multiple pathways. Two possible routes concern the sequential addition of hydrogen (H_2) and CO_2. While CO_2 insertion into a M-H bond is the accepted mechanism to formate production, our kinetic results suggest that H_2 can add into a C-CO_2 bond, whereby the CO_2 is already activated via the ligand. We use simple spectroscopic techniques to monitor each reaction and determine the appropriate rate constants, which we consider in a broader mechanistic context.

Poster 2
Presenter: Paola Fonseca-Romero (University of Utah)
Mentor: Anne Blaschke (Pediatrics)
Diagnostic utility of multiplex PCR-based assay on pleural fluid of children with parapneumonic empyema.

Pneumonia is a common cause of serious illness in infants and children. Parapneumonic empyema (PE) complicates pneumonia when purulent fluid collects in the pleural space and can require prolonged antibiotic therapy. PE is primarily caused by infection with bacterial pathogens including Streptococcus pneumoniae, Staphylococcus aureus, and S. pyogenes. Culture of blood and pleural fluid is used to identified causative organisms; however, culture can be low yield if patients have received antibiotics. We aim to further understand the epidemiology of PE by utilizing a PCR-based assay for pathogen detection. Pleural fluid (PF) specimens were collected from children with PE. Demographic, clinical and microbiologic data were abstracted from the medical record. PF specimens were tested with the Bio Fire BCID Panel, a multiplex PCR-based assay detecting 19 bacterial pathogens. We collected 121 PF specimens from children with PE. A bacterial pathogen was identified by culture in 32% of patients. We performed PCR on 19 PF specimens. Nine PF specimens were culture positive; PCR identified a concordant organism in 8 cases. Ten PF specimens were culture negative, PCR identified a pathogen in 6 cases. S. pneumoniae was identified in 42% (8/19) of cases, followed by S. pyogenes in 21% (4/19) and H. influenzae in 5% (1/19) cases. PCR is a rapid and specific method for the detection of pathogens in pleural fluid. PCR-based diagnostics expands our understanding of the epidemiology of PE in children. This methodology will help improve the treatment of PE by improving the speed and accuracy of pathogen identification.

Poster 3
Presenter: Laila Batar (University of Utah)
Mentor: David Gillespie (Neurosurgery)
HIF-1α and Hypoxia in Glioblastoma and meningioma tumors

Hypoxia is where a region or part of the body is deprived of oxygen. In cancer, hypoxia is common in brain tumors, such as glioblastoma, and meningioma. Hypoxia Inducible Factors, specifically HIF-1α, are very big in hypoxia, and results can lead to allowing tumors to grow, and allow metastasis to occur. To stop tumor growth and metastasis from occurring, we are using siRNA protocols to hinder the HIF-α, and CRISPR to knockout HIF-1α in different types of cell lines. Methods: Extracting DNA from multiple cell lines, with a simple process, and ending up with the pellet of DNA mixed with TE buffer, and RNase A. Once done with that process we validate it with the nanodrop, seeing how much DNA is in just one microliter of the sample. Extracting DNA from the cell lines and validating the samples also allows us to see if our results are constant, or changing throughout time. Another crucial method was transfecting the cells with an adenovirus. We first began by growing 193 A-I cells, passaging them, and then putting them in 6 plate wells. Once that is done we began to put them in flasks, adding the virus, and also creating a positive and negative control. Results: Unfortunately, only one of the flasks survived, the AD1 cells, with the infection still continuing to grow in them. Future plans: the lab will continue to infect cells, and further DNA extractions with PCR, running gels and ELISA (enzyme-linked immunosorbent assay), to determine knockout effiency, and to find a solution for both malignant and benign tumors.

Poster 4

Presenter: Jaime Richards (Creighton University)
Mentor: Matt Wachowiak (School of Biological Sciences)
Optical measurement of basal forebrain neuromodulation of the olfactory bulb

The basal forebrain (BF) is thought to be involved in attention and active sampling of sensory information. Neurons within the BF regulate functions associated with learning, reward, decision-making, emotive responses, and sensory processing. However, little is known about how BF neurons are activated during olfactory related behavior. In this project, our goal was to understand how neurons in the basal forebrain are activated in the behaving animal in the context of active sniffing, attention, sensory input and reward. The olfactory bulb is advantageous for investigating BF function, as it is the only primary sensory structure modulated by BF neurons. Neural activity will be tracked with GCaMP6f reporters in cre-ChAT and GAD-2-cre transgenic mouse lines to monitor activity in cholinergic and GABAergic neurons, respectively. We are using in-vivo fiber photometry to monitor activity within the basal forebrain to record real-time neural population activity.Mice are trained in a Go/No-Go paradigm to discriminate between two odors using a water reward. While mice are performing the task, BF neuron activity is monitored using implanted fiber optics, and sniffing is measured using an implanted thermistor. The implanted thermistor provides precise measurements of inspiration onset in response to odor presentation. This data, along with neuronal activity data, will indicate if behavior is driving neural responses. We hypothesize basal forebrain neurons will respond to active sniffing during odor presentation in awake mice. Ultimately, this experiment will highlight the role of neural BF projections to the OB, and shed light on their role in olfactory processing.

Poster 5

Presenter: Jared Coles (University of Utah)
Mentor: Shanti Deemyad (Physics & Astronomy)
Structure Studies of CeTiGe3 Under Pressure

Under extreme conditions the structure of atoms in materials is affected. We can change the temperature and pressure which a material is experiencing to observe what changes occur; such as structural changes, magnetic property changes, and in some cases superconductivity. This research was a case study of CeTiGe3, a ferromagnetic material, in helium pressure transmitting medium. The measurements were conducted under pressure using single crystal x-ray diffraction in a synchrotron. No phase transitions were observed, but structural shifts were seen at ambient temperature with increased pressure from ~0-10 GPa. Further investigations of the magnetic properties of CeTiGe3 can be carried out to relate structural properties to magnetic properties.

Poster 6

Presenter: Marcus Blackburn (University of Utah)
Mentor: Frank Sachse (Bioengineering)
Cellular Structures Involved in Heart Contraction Degrade With Age

Heart disease continues to be the leading cause of death in the United States and accounts for one in every four deaths in patients 65 and over. Heart failure is a specific heart disease where the heart weakens to the point that it cannot pump effectively, and affects approximately 7% of men and 5% of women over 60 the United States. Some of the major components that take part in the conversion of cardiomyocyte excitation to its contraction are transverse tubules (t-tubules), ryanodine receptors (RyR), and junctophilin-2 (JPH2). T-tubules and RyRs remodel in heart disease, leading to less effective contraction. However, there is not an explicit characterization between t-tubule, RyR, and JPH2 remodeling with age. Confocal image stacks of t-tubules, RyRs, and JPH2 were obtained from left ventricular myocardial tissue slices of two human donor hearts of ages 21 yr (young) and 69 yr (old). These 3-dimensional (3D) image stacks of the t-tubules, RyRs, and JPH2 were then processed and visualized to study the spatial distribution of the three structures relative to each other. The 3D reconstructions of the two samples were visualized. The t-systems in the young and old donors are similar; however, the RyR clusters are more numerous and closer to the t-tubules in the younger donor than in the older donor. The JPH2 clusters follow a similar pattern but are even less numerous in the older donor than in the younger donor. These preliminary results from the young and old donors suggest that as a heart ages there is an observable degree of remodeling between the three components and that the three components' relative distances to each other increase. More data is needed to further investigate the relationship between aging and cardiomyocyte structure remodeling.

Poster 7

Presenter: Brittney Hayes (University of Utah)
Mentor: David Curtis (Family & Consumer Studies)
Economic patterning of parks in the Wasatch front: The importance of measuring quality

Research has found that socially and economically deprived neighborhoods tend to have poorer park access, though some of these findings have been mixed. Due to previous literature, we believed it was important to integrate measures of park quality into our study. Our first aim was to complete a randomized list of 100 in-person standardized assessments of parks, to validate online assessments of park quality. Our second aim was to complete online assessments of all ~ 900 parks in the Wasatch front. Online assessments and in-person assessments included activity spaces (9 items), amenities (12 items), and attractiveness. Our initial findings have allowed us to tentatively claim that online assessments are a valid measure of park characteristics, allowing for greater research efficiency. We also found that park quality is correlated with neighborhood sociodemographic characteristics. Specifically, park quality is lower in neighborhoods with greater deprivation, higher population density, larger ethnic minority populations, and fewer youth.

Poster 8

Presenter: Aria Ballance (Lewis & Clark College)
Mentor: Jennifer Shumaker-Parry (Chemistry)
Polymer-Coated Diamond Supports for Noble Metal Nanoparticle Catalysts

Supported noble metal nanoparticles have been used for a variety of catalytic applications. However, relatively little is known about the impact of local chemical environment on the behavior of noble metal catalysts. In order to better understand how nanoparticle catalysts are affected by different chemical environments, a robust and tunable support material of polymer brushes with variable functional groups grown from synthetic diamond particles was developed. The surface of the diamond was modified with an initiator moiety and then polymer brushes were grown using surface-initiated atom-transfer radical polymerization (SI-ATRP). The polymer brushes were characterized using thermogravimetric analysis (TGA), Fourier transform infrared (FTIR) spectroscopy, and scanning transmission electron microscopy (STEM) results have shown that polymer brushes have been successfully grown from the surface of the nanodiamonds.

Poster 9

Presenter: Issachar Kirk (Western Kentucky University)
Mentor: Stavros Drakos (Internal Medicine)
Improving Cardiac Recovery in Heart Failure Patients: Role of MPC1 In Heart Failure

Heart failure (HF) is a complex syndrome and is known to have high mortality rates globally. This disorder is caused by a number of different factors such as hypertension, obesity, and coronary artery disease that often time leads to symptoms such as dyspnea, arrythmias, and palpitations. Recent studies have shown that utilization of a left ventricular assistant device (LVAD) has aided a small percentage of people in cardiac recovery. A small percentage of the population show improved cardiac function in terms of ejection fraction (EF) and left-ventricular end diastolic diameter (LVEDD). The people who recovered were termed as "responders" and those who did not recover were termed as "non-responders". The process of reverse remodeling has been approached by better understanding the protein levels, metabolic mechanisms, and genes expression. RNA-sequencing between the responders and non-responders show diffrenetial gene expression which could drive recovery, specifically, an upregulation in the gene expression of mitochondrial pyruvate carrier 1(MPC1) in responders. A cardiac-specific deletion of MPC1 has been shown to cause heart failure in adult mice and contrarily we hypothesize an overpression of the gene will rescue the phenotype. To further characterize the MPC1 mutant, we will examine the metabolism, gene expression, mitochondria structure, respiratory function, and myocardium structures in these mice in comparison to the wild type littermate to understand the mechanism and to identify the therapeutic targets for drug development.

Poster 10

Presenter: Maria Salazar (University of Utah)
Mentor: Don Ayer (Oncological Sciences)
Protein synthesis inhibitors stimulate MondoA transcriptional activity in Burkitt's Lymphoma cells

Cancer cells use nutrients differently compared to normal cells to support their high growth rates. Understanding how cancer cells sense and respond to nutrients, especially to glucose as it is the most abundant nutrient in the human body and dysregulation of glucose homeostasis is seen in almost every cancer type, is instrumental to developing ways to restrict glucose use and reduce the growth of cancer cells. MondoA, a transcriptional factor that is required for all glucose-directed gene expression in mammalian cells, is regulated by glucose and is also dramatically upregulated by protein synthesis inhibitors. Activation of MondoA drives expression of the Thioredoxin Interacting Protein (TXNIP), which is a potent negative regulator of glucose uptake and repressor of Myc. The anti-cancer therapeutic Rocaglamide A (RocA), functions as a translational initiation inhibitor and leads to increased levels of mitochondrial ATP (mATP). mATP is exported from the mitochondria and consumed by mitochondria-bound hexokinase, leading to a dramatic increase in glucose-6-phosphate (G6P), which is a known potent activator of MondoA transcriptional activity and TXNIP expression. We observed that RocA is cytotoxic against cell line models of Burkitt's Lymphoma, an aggressive childhood cancer with

poor prognosis that presents a great model for Myc dependent cancers, and requires to a certain extent both MondoA and TXNIP to reduce cell viability. Understanding how RocA induces TXNIP expression and the glucose-dependent gene expression programs driven by MondoA is significant in investigating new therapeutic avenues. These findings show a mechanism in which protein synthesis exerts control over glucose uptake by controlling the activity of the MondoA transcription factor, and provide a mechanistic link between translation rate, mATP levels, MondoA transcriptional activity, and glucose availability.

Poster 11

Presenter: Lori Begaye (University of Utah)
Mentor: Michelle Debbink (Obstetrics & Gynecology)
Undertreated iron deficiency anemia increase the risk of postpartum blood transfusion

Transfusion is a common cause of severe maternal morbidity (SMM) as defined by the Centers for Disease Control and Prevention (CDC), and is often associated with postpartum hemorrhage. Women with anemia are more likely to receive transfusions. Iron deficiency (IDA) represents the commonest form of anemia, but it is unknown whether treatment improves maternal outcomes. We hypothesize that undertreated IDA increases risk of transfusion-related SMM compared to treated IDA, and access to prenatal care may drive this relationship. We are conducting a retrospective cohort study of all deliveries at a single institution in Utah from October 2015 - September 2018. Discharge and medical records data were reviewed to identify women with IDA during pregnancy and transfusion after delivery. Univariate and multivariate regression will be used to assess the relationship between transfusion and anemia. Mediation analysis will be used to assess the impact of prenatal care. The cohort includes 13,034 women, of whom approximately 210 are predicted to have a transfusion event. Based on prevalence, approximately 900 women are predicted to have IDA in the first trimester, and approximately 1900 in the second. Assuming half are successfully treated for IDA, we will have ~80% power to detect a three-fold difference in transfusion risk between women successfully treated for IDA. Pre-delivery anemia is common, affecting about 15% of all deliveries. Our research will determine if treating anemia reduces transfusion risk and identify systems-level risk factors for undertreated anemia. We hope this will identify a target population for reducing preventable SMM.

Poster 12

Presenter: Chandler Merrill (University of Utah)
Mentor: Christoph Boehme (Physics & Astronomy)
Spin Relaxation Times of Copper Phthalocyanine (CuPc) Qubits diluted in Diamagnetic Zinc Phthalocyanine Host Matrices

Electron paramagnetic resonance (EPR) spectroscopy observes allowed transitions among non-degenerate eigenstates of electron spins caused by magnetic fields using the magnetic dipole moment. As chemical bonds are diamagnetic pairs of electrons, EPR spectroscopy is sensitive typically only to unpaired electrons and, thus, it is an excellent technique for the observation of point defects, paramagnetic molecules, ferromagnetically interacting domains of electrons, and free radicals. Among many other applications, this allows the study of the magnetic properties of condensed matter, i.e. for materials research. This study uses EPR spectroscopy to investigate the quantum mechanical coherence times (also called transverse spin relaxation time T_2) of CuPc, a paramagnetic compound. The free electron spin of CuPc effectively constitutes a two-state quantum system, that potentially, may be a suitable quantum bit (qubit) for quantum computing applications. Our Hypothesis was that the CuPc electron spin may increase its T_2 when the magnetic and quantum mechanical (so called exchange) interactions between adjacent CuPc qubits is reduced. In order to test this hypothesis, we diluted CuPc molecules in a zinc phthalocyanine (ZnPc) host matrix at various concentrations of 0%, 1%, 5%, and 10% causing a variance of the average CuPc distances. ZnPc is diamagnetic molecule that does not exhibit an EPR signal. We used a Bruker ELEXSYS E580 X-band (~9.7GHz) EPR Spectrometer to apply an external magnetic field as well as coherent microwave irradiation needed for the measurements. Experimentally, we applied an oscillating magnetic field B_1 in the form of microwave radiation whose magnetic polarization component was oriented perpendicular to a static, homogeneous magnetic field B_0, in order to establish magnetic resonance. The results of these experiments yielded various T_2 times on the scale of 1 μs observed for both the CuPc signals as well as another unidentified paramagnetic signal that is likely caused by contamination of the ZnPc matrix.

Poster 13

Presenter: Tory Glomb (University of Utah)
Mentor: Julio Facelli (Biomedical Informatics)
Structural Profiling of MicroProteins: Aiding in the Classification and Identification

MicroProteins are small, single-domain proteins, usually less than 100 amino acids in length. Previous research has tried to classify the differences between a small proteins and a MicroProteins. However, there are varied interpretations as to how micro-proteins should be identified leading to a poor definition of exactly what constitutes a MicroProtein. The goal of this research is to find if there are structural features that are characteristic of MicroProteins. We selected 48 well characterized and suspected MicroProteins from the SWISS PROT repository, from which we extracted their amino acid sequences. These sequences were used as input to QUARK, in order to predict 3-D models of each protein. From the predicted tertiary structures, DSSP and bmi scripts were used to predict the secondary structures of these proteins. The secondary structures were used to determine the prevalence of turns, coils, and helix. We used BLAST, STRING, and RaptorX to get information on binding sites, structural properties, gene connections, and functions. Comparisons of structural disorder, the types of solute binding, turns, coils, and helix percentages, gene connections and functions were used to create the structural profiles of the MicroProteins. In future work we will use machine learning techniques to classify these features. *This research was supported by a Supplement to the NLM Training grant T15 LM00712418, with additional support from the Utah Center for Clinical and Translational Science funded by NCATS award 1ULTR002538. Computer resources were provided by the University of Utah Center for High Performance Computing, which has been partially funded by the NIH Shared Instrumentation Grant 1S10OD02164401A1.*

Poster 14

Presenter: Lauren Thompson (University of Utah)
Mentor: J. David Symons (Nutrition and Integrative Physiology)
Inducible disruption of endothelial cell ceramide biosynthesis: Vascular implications

Type II diabetes mellitus (T2DM) is an epidemic worldwide. Cardiovascular complications (e.g. endothelial dysfunction and hypertension) are associated with T2DM. T2DM affects the quality of life for the patient and their caregivers, and the costs for treating cardiovascular complications are unsustainable. An urgent need exists to elucidate new therapeutic targets for intervention. Our laboratory is interested in defining the contribution from the sphingolipid ceramide. We reported earlier that arterial dysfunction and hypertension that otherwise develop in mice that consume an obesogenic diet is attenuated by pharmacological inhibition of ceramide using myriocin and by germline haploinsufficiency for dihydroceramide desaturase (DES1), an enzyme required for ceramide biosynthesis. However, each study had limitations. Myriocin improved systemic glucose homeostasis, and DES1 inhibition elevated dihydroceramides, both of which could impact arterial function. In the present study, we used a novel murine model to inhibit the rate-limiting enzyme responsible for ceramide biosynthesis (serine palmitoyl transferase light chain 2; *Sptlc2*) specifically in endothelial cells (ECs). We hypothesized that EC specific inhibition of ceramide biosynthesis would preserve arterial function in obese mice. 6-week-old male mice with intact *Sptlc2* (wild-type; WT) and EC specific deletion of *Sptlc2* (iecSptlc2KO mice) consumed either standard (CON) or high fat diet (HFD) for 14 weeks. qPCR results indicated *Sptlc2* was knocked down > 80% in ECs but not media and adventitia from iecSptlc2KO vs. WT mice. Results were similar between WT and iecSptlc2KO mice concerning glucose, insulin, and pyruvate tolerance tests (indicating intact glucose homeostasis) and lean mass, fat mass, and fluid mass (indicating body composition was unaltered). Of note, intraluminal flow-mediated vasodilation was greater in femoral arteries from iecSptlc2KO vs. WT mice that consumed high-fat chow. Preventing ceramide biosynthesis specifically in ECs from mice that consume an obesogenic diet might be vasculoprotective.

Poster 15

Presenter: Lauren Ericksen (University of Utah)
Mentor: Tiffany Love (Psychiatry)
Impact of Chronic Pain on Neural Responses to Monetary Reward and Loss

Chronic pain conditions are hypothesized to interfere with reward-related behaviors and motivation. Unfortunately, the neurobiological mechanisms underlying reward-processing in chronic pain conditions are not well understood. Previous research has shown that chronic pain affects men and women differently, both in regards to how prevalent it is in the sex, as well as its originating cause. However, no studies to date have examined the effects of chronic pain and sex on reward-related functioning. Here, we examine the differences in neurobiological responses both monetary reward and loss using the monetary incentive delay (MID) task. In brief, we utilized functional magnetic resonance imaging (fMRI) in order to explore if there are similar neuroadaptations in the reward pathways of men and women, with and without chronic pain conditions.

Poster 16

Presenter: Jonathan Maturano (Rowan University)
Mentor: Jon Rainier (Chemistry)
Synthesis and Characterization of Novel SrtA Inhibitors in S. Aureus

With the advent of new antibiotic resistances and the consistent decline in the effectiveness of traditional antibiotic methods, small molecules with potential anti-virulence character have risen to the forefront of interest among many

laboratories. Within the Discorhabdin family of natural products, isolated from *Sceptrella Sp.*, many have shown potent anti-virulence activity against numerous species of gram-positive bacteria. Specifically, Discorhabdin Z has shown this desirable anti-virulence character, with the unfortunate challenge of relatively potent cytotoxicity. The purpose of this research was to develop a library of structural analogs of Discorhabdin Z which featured prominent classical and bioisosteres to increase the potency of the antagonistic activity while simultaneously reducing the cytotoxicity. The reactions to form these indoloquinone structures analogous to Discorhabdin Z and the characteristic cyclic lactam ring observed were accomplished via a 6 pi electron photoelectrocyclization reaction. Compounds A and B were synthesized and characterized through various physical and spectroscopic methods. Both were then tested against control strains of S. Aureus to determine anti-virulence activity and lethality to gram positive cells. After optimizing activity and minimizing cytotoxicity through structural-activity relationship studies, the intention is to provide a novel approach to quorum sensing inhibition that could hopefully provide an alternative approach to antimicrobial therapy and minimize the development of bacterial resistance.

Poster 17

Presenter: Shai Miguel (University of Utah)
Mentor: H Joseph Yost (Neurobiology & Anatomy)
Effects of Histone Deacetylase inhibitors during neurodevelopment in Kabuki Syndrome Zebrafish

Kabuki Syndrome (KS) is a congenital disorder that affects neurodevelopment amongst other systems. It is known that 70% of KS cases result from mutations in the histone methyl-transferase *kmt2d* gene. KMT2D protein promotes an open state of the chromatin allowing specific genes to be transcribed. In our lab we generated a zebrafish model for KS that recapitulates the main clinical manifestations of KS patients. Previous studies in our lab demonstrated that *kmt2d* null mutant zebrafish brains have increased neuronal progenitors, increased mitotic cells, and decreased mature neurons. Our hypothesis is that inhibition of histone deacetylases will create an open state of the chromatin and allow the transcription of neurodevelopmental genes. In order to test our hypothesis, we incubated 24 hours post fertilization (hpf) zebrafish embryos in the HDAC inhibitors (either Vorinostat or AR-42). A DMSO-treated group was included as a vehicle control. The methods used for analyzing neurodevelopment are immunofluorescence and super-resolution confocal imaging. The markers that were used are: HuC/D for early neuronal precursors, Sox2 for neuronal progenitors, and Phospho-Histone 3 (pH3) for mitotic cells. Image analysis and pH3 positive cell quantification was performed using Imaris 9.3 software. Our preliminary results suggest that forcing an open state of the chromatin by treatment with HDAC inihibitors is not sufficient to rescue the cell proliferation phenotype in zebrafish KS. These results allow us to propose that neurodevelopmental defects in zebrafish KS might be caused by in part mechanisms independendent of the histone methyltransferase activity of *Kmt2d*.

Poster 18

Presenter: Mason Rogers (Southern Utah University)
Mentor: Jared Bergman (Oncological Sciences)
Modulating the ERK pathway to investigate its effect on the ERM family proteins

Biochemical experiments performed by Dr. Bergman in the Mendoza Lab suggest that ERK pathway modulation affects phosphorylation levels of the ERM protein family (Ezrin, Radixin, Moesin). This observation warrants further investigation as phosphorylation of membrane bound ERM proteins dramatically alters their structural conformation. When phosphorylated, the ERM proteins unfurl to expose their actin binding domain. This process is essential for linking the underlying actin cytoskeleton to the cell membrane. This action increases membrane stiffness which likely influences other cell processes such as cell migration/invasion. Due to the importance of ERM protein activation, further investigation of this proposed ERK-ERM connection is critical, as ~ 50% of solid tumors have elevated ERK activity (Salaroglio, 2019). It is well established that both the motility of cells and their membrane protrusion rates decrease after ERK inhibition (Mendoza, 2015; Arpin, 2011). However, the mechanisms that control this phenomenon are still not well understood. We sought to validate Bergman's preliminary results using differing techniques, and to study how ERK pathway inhibition changes cancer cell morphology and subcellular localization of phosphorylated ERM. To this end, we performed immunofluorescence staining so that we could visualize the cells with microscopic techniques. Additionally, to quantify cellular changes in an unbiased manner we employed an immunofluorescent plate reader to scan the fluorescence intensity emitted from the various ERK inhibitor treated samples. Using immunofluorescent techniques, we collected data that corroborated Bergman's preliminary results, that ERK pathway inhibition increases levels of phosphorylated ERM. In addition, we observed filipodial structures to form in a high percentage of the cells subjected to ERK pathway inhibition drugs. In these structures we observed strong phosphorylated ERM signal. This data suggests that ERK inhibition stimulates filopodia formation and enrichment of phosphorylated ERM to these structures.

Poster 19

Presenter: Justin Hollowell (University of New Mexico)
Mentor: Justin Y (Internal Medicine)
Hypoxia and Depression in ILD patients

Many patients affected by interstitial lung disease (ILD) also suffer from several depressive symptoms. Although it is not uncommon for depression to be concomitant with chronic maladies, recent convergent studies elucidate that hypoxia related to chronic diseases such as idiopathic pulmonary fibrosis (IPF) along with other pulmonic and cardiovascular diseases suggest that hypoxia may be a veritable driver in dysthymia. Significant regional variations in the rates of hypoxia and dysthymia indicate that environmental conditions appose to socioeconomic or health status may be the preponderant factor to the prevalence of depression sequelae of hypoxic effects on tryptophan metabolism and monoamine deficiency. Further, it is possible that inflammatory processes are responsible for this finding. Several biomarkers for inflammatory and immune response, as implicated in the Kynurenine Pathway; cytokines (IL-1, IL-6, TNF-α) are currently recognized as having substantial roles in depression. We hypothesize that elevated levels of inflammatory biomarkers will be consistent with higher PHQ-9 scores and congruent in subjects who exhibit lower blood O2 saturation levels. We will collect plasma inflammatory biomarkers, conduct a single depression questionnaire (PHQ-9), and record O2 blood saturation at rest and post 100ft walk-test from volunteering University of Utah hospital ILD patients (study population, n= 80) and non-ILD participants (the control, n=20), generally, spouses to account for similarities to exposure. Data will then be inputted into a database for statistical analysis. We postulate that results yielded from our study will be conclusive with our hypothesis that there exists a strong positive correlation between hypoxia and dysthymic depression.

Poster 20

Presenter: Gabriela Torrini (The Ohio State University)
Mentor: Udara Abeysekara (Physics & Astronomy)
Studying Spatially Extended Gamma-Ray Sources with VERITAS

The Very Energetic Radiation Imaging Telescope Array System (VERITAS) observes astronomical sources emitting gamma-rays in the energy range from 100 GeV to >30 TeV. VERITAS can detect a point-like source with 1% of the Crab Nebula flux in a 25-hour long exposure. During the past decade, VERITAS has observed the Geminga supernova remnant for 93 hours. Although Geminga has 23% of the Crab Nebula flux, it has not been successfully imaged yet due to its large spatial extent of 2.6° (angular diameter). Geminga occupies over 5 times more space in the sky than the moon. Currently, two standard methods are used to subtract the cosmic ray background from raw images of a gamma-ray source. To estimate the background, these methods compare the source to surrounding areas within the telescope's field of view (FOV). However, these methods do not work for spatially extended sources like Geminga, where the region of interest (ROI) is larger than the FOV. The Matched Runs Method (MRM) was developed to allow for comparison between the ROI and other regions of the sky. The MRM algorithm estimates the background by matching observations from different sources with similar characteristics. I optimized the algorithm by studying how parameters such as gamma-ray shower shape, elevation, azimuth, and time affected the success of matches. The improved version of the MRM will enable VERITAS to image spatially extended sources.

Poster 21

Presenter: Tim Hui (Boston College)
Mentor: Stavros Drakos (Internal Medicine)
MPC1 DEFICIENCY CAUSES HEART FAILURE AND EXACERBATES REPERFUSION INJURY IN A MOUSE MODEL OF ISCHEMIA-REPERFUSION

Coronary artery disease and its role in myocardial infarction (MI) has become the leading cause of death and disability globally. Treatment of MI has improved with advances in reperfusion. However, up to 50% of the damage that occurs after acute myocardial Infarction (AMI) is due to reperfusion injury. Unfortunately, there has been little success in reducing reperfusion injury. Our study utilized an Impella, a percutaneous ventricular assist device, to unload the left ventricle (LV) of a porcine heart while simultaneously reperfused the ischemia, resulting in more salvaged myocardium. Furthermore, a recent study of a porcine ischemia reperfusion (I/R) injury model has implicated a transporter protein, Mitochondrial Pyruvate Carrier (MPC), as being cardio-protective during I/R. The study reported isolated mouse hearts subjected to I/R indicated that inhibition of MPC using an inhibitor exacerbated myocardial infarction. While the exact mechanism of MPC in I/R injury is not well understood, we hypothesize that the reduced level of MPC in cardiac muscle will exacerbate the impact of IR injury in adult mice. To test this, cardiac specific and inducible MPC1 knockout mice were generated through cre-loxP-mediated-Recombination which allows the gene to be deleted when the mouse is 8 weeks old upon tamoxifen injection. The MPC1-/- mouse revealed signs of heart failure 10-12 weeks post-induction such as, an increase in left ventricular end diastolic diameter, decreased ejection fraction, and increased LV mass as compared to the wild type littermates. Preliminary data of I/R injury on these mice before development of heart failure symptoms

indicated that the MPC1 deficiency exacerbated the MI in comparison to the control group. The MPC1 deficient mice were prone to mortality during the procedure hinting at a role of MPC1 in myocardial salvage during I/R. In the future, we will examine the metabolic profile and gene expression in these mice during I/R.

Poster 22

Presenter: Allison Jacobsen (University of Utah)
Mentor: Joel Harris (Chemistry)
Confocal Raman Microscopy to Investigate the Protein Repellency of Hybrid-Lipid Bilayers

Protein-repellent surfaces are needed as substrates for the development of selective protein biosensing as well as new biocompatible materials for implants and other applications. Proteins readily adsorb strongly to most solid surfaces, so that preventing adsorption on a surface is challenging. Phospholipid bilayers, which are the primary components of membranes, are uniquely protein-repellent. In this work, we are constructing a hybrid-model of such a membrane by adsorbing phospholipid to an n-alkyl chain modified surface and testing the resulting bilayers for their protein-repellent properties. We employ confocal Raman microscopy to detect protein adsorption to porous silica particles whose surfaces are modified with n-alkyl chains, where the impact of a protein-repellent hybrid-lipid bilayer is tested. Spectroscopic data indicate that a model protein, bovine serum albumin, readily adsorbs to the n-alkyl chains of the original silica particles. This phenomenon, evidenced by scattering from the phenylalanine breathing mode of the protein, is detectable even at micromolar concentrations of protein. In contrast, hybrid-bilayer particles formed using the lipid dipalmitoyl-sn-glycero-3-phosphocholine (DPPC) exhibit high protein repellency when exposed to solutions of bovine serum albumin. No detectable protein adsorption occurs to the hybrid bilayer, even at 1000-fold higher (millimolar) protein concentrations. This indicates both complete bilayer formation on the interior surfaces of the particles and the validity of these bilayers as a protein-repellent surface. In future work, the capability of these lipid bilayers to avoid nonspecific protein interactions may be harnessed to develop surfaces in which protein adsorption only occurs at specifically engineered binding sites. For example, the formation of net positively-charged bilayers using a cationic lipid dispersed within DPPC may allow for the retention of negatively-charged proteins through electrostatic interactions, allowing for the study of a new potential form of ion-exchange media.

Poster 23

Presenter: Maddy Schultz (California Polytechnic State University San Luis Obispo)
Mentor: Daniel Rodriguez (Chemistry)
Single Nanoparticle Mass Spectrometry and Spectroscopy for the Kinetic Studies of Carbon-based Materials

The temperature dependent mass loss kinetics of different carbon-based materials (graphene platelets, nano diamonds, carbon black etc.) were analyzed using a nanoparticle ion trap mass spectrometer (NPMS). The NPMS method allows individual charged nanoparticles to be electrodynamically confined in a split-ring quadrupole ion trap (SRET)[1]. The SRET confines NPs indefinitely allowing us to measure the mass, charge and "black body" like emission of a single isolated nanoparticle, heating the NP using either a 10.6μm CO_2 laser or a 532 nm visible laser[2]. These methods have allowed us to determine that the blackbody-like emission spectra for different carbon-based nanoparticles ranging in sizes from 10 nm up to 30 nm are all similar. Interestingly, the sublimation kinetics for all the systems seem to follow Arrhenius behavior, allowing us to extract activation energies as a function of surface evolution as well as pre-exponential factors which help us understand how the particle's surface sites evolve with time. In addition to sublimation kinetics studies, the temperature dependent oxidative mass loss kinetics for single nano diamond particles were determined. Nanodiamonds have unusual oxidation kinetics, with rates that fluctuate over time, even though the temperature and oxygen partial pressure are constant.

Poster 24

Presenter: Tunji Adeniran-Adetoye (Morgan State University)
Mentor: Clement Chow (Human Genetics)
Investigating the Interaction between NGLY1 and CDG Genes in Drosophila

Glycosylation involves many genes that encode proteins involved in forming and modifying glycans. Mutations in many of these genes lead to a variety of multi-organ disorders. Congenital disorders of glycosylation (CDG) is an umbrella term for rare autosomal recessive disorders of metabolism affecting glycosylation. Mutations in the N-Glycanase 1 (NGLY1) gene cause NGLY1 deficiency, the only known disorder of deglycosylation. NGLY1 is thought to deglycosylate misfolded proteins that are degraded by ER-associated degradation (ERAD). Patients with NGLY1 deficiency present with various symptoms, including developmental delay, movement disorder, seizures, and liver dysfunction. It is unknown why mutations in NGLY1 results in these symptoms. To better understand what might be disrupted in NGLY1 deficiency, we

employed evolutionary tools. We identified genes that co-evolved with NGLY1 using evolutionary rate covariation (ERC) analysis. ERC measures correlated evolutionary rates across the animal phylogeny. We hypothesized that genes that co-evolve with NGLY1 must function in similar pathways as NGLY1. Surprisingly, of the ~150 known CDG genes, 29 co-evolve with NGLY1, suggesting that there is an essential connection between NGLY1 and the broader glycosylation pathways. Some of these CDG genes include components of N-linked glycosylation and GPI anchor biosynthesis, among others. To test for interactions between NGLY1 and co-evolving CDG genes, we used RNAi technology to knockdown candidate genes in neurons and glia of a Drosophila Melanogaster NGLY1 deficiency model using a UAS/GAL4 system. We will present data on how NGLY1 interacts with these co-evolving CDG genes. Understanding NGLY1 deficiency will likely provide insight into other CDGs

Poster 25

Presenter: Kyler Zarate (University of Utah)
Mentor: Clothide Penalva (School of Biological Sciences)
Functions and Effects of Eyes-Shut Protein during intestinal regeneration in Drosophila melanogaster

The *Drosophila melanogaster*, the fruit fly, is used in genetic research for their easy maintenance and storage capabilities; making them a convenient option when tracking multiple generations with specific mutations, having a short lifespan and fast reproduction cycle compared to mice or other common test subjects. The fruit fly also only has four chromosomes, allowing for more accurate mutations. For these reasons, my lab chose to mainly use fruit flies for research. Although the fruit fly provides many focuses of research, my lab has been studying the fly's small intestine, more specifically the midgut and it's epithelium. The epithelium renews itself constantly with intestinal stem cells (ISC), that either self-replicate or grow into an enteroblast, which can then turn into an enterocyte or enteroendocrine, both of which contributes to the intestine's homeostasis. However, little is known about how the epithelium recognizes damages or how regeneration is activated. To understand this process, we have been studying the Eyes-shut (eys) protein. This protein is most known for its functions in the fly's eyes, maintaining the retina and managing the spacing of the photoreceptors, and its nervous system, with the maintenance of mechanoreceptor neurons. The protein is also present in humans, with the same function of maintaining the eye. However, when the intestine is introduced to a stress and experiences damage, by either a *Pseudomonas entomophila* (P.e.) or *Erwinia carotovora carotovora 15* (Ecc15) bacterial infections, eys has been suggested to have a role in the renewal of the fly's intestines. Introducing these stresses to mutated flies by feeding them a bacteria/sucrose solution, and dissecting them to retrieve the midgut, we can observe the replication of stem cells in the epithelium. Understanding the effect of eys on intestinal regeneration will help us in understanding the regeneration of cells and possibly different cancers.

Poster 26

Presenter: Olathe Antonio (Fort Lewis College)
Mentor: Celestia Buckley (Psychology)
Predictors of Psychosocial Impairment of Children with Insomnia

Research suggests that parental stress is a determining factor of treatment effectiveness in pediatric clinical settings, and is higher for parents who have children with sleep disorders. Furthermore, children who have sleep disorders have high risk of comorbidity with neurobehavioral problems. For example, anxiety and depression can both be influenced by and result in poor sleep patterns. ADHD also commonly affects quality and duration of sleep. On the contrary, sleep issues can affect psychological factors like attention and memory. The purpose of this study is to determine the association between different factors including parental stress, age, gender, psychiatric disorders, and psychosocial impairment in children with chronic insomnia. We included 100 children (56% Male, 44% Female; Mage = 9.74 years, SD = 5.34) seen in the sleep behavioral health clinic whose caregivers had completed both the Parental Stress Scale (MdnPSS = 37, Range = 61) and the Pediatric Symptoms Checklist (MdnPSC17 = 12, Range = 24; PSC ≥ 43%). A multiple regression using maximum likelihood model (MLM) was used to investigate whether parental stress, patient's age, gender, and comorbid psychiatric disorders could significantly predict patients' psychosocial impairment. Results showed that patients with comorbid psychiatric disorders reported 4 units of increase in psychosocial impairment (B = 4, p = .00), holding other variables constant. This indicates that patients with comorbid psychological disorders reported more psychosocial impairment. With every one-year increment in age, the patient's psychosocial impairment decreased by 0.30 units (B = -0.30, p < .05), holding other variables constant. Older children reported less psychosocial impairment. Results indicated that the model explained 22% of variance and was a significant predictor of a patient's psychosocial impairment (B = 0.22, p = .00). Therefore, pediatric insomnia treatment for children should address both parental stress and children's impairment.

Poster 27

Presenter: Vivian Carvajal (University of Maryland, College Park)
Mentor: Daniel Wik (Physics & Astronomy)
Searching for Evidence for the Merger-Minihalo Connection in Ophiuchus Cluster

Galaxy clusters are the largest gravitationally bound systems in the observable universe. Measurements of their masses are often used to determine cosmological parameters, which in turn tell us how the universe has evolved through time. However, methods for measuring these masses are very sensitive to disturbances in the intracluster medium (ICM), so clusters with relaxed "cool cores" (CCs) are preferred, as that signals that the cluster has not been disrupted by merger activity recently. However, these CCs tend to be accompanied by radio structures known as minihalos with no apparent source. One theory for the formation of these minihalos is that turbulence induced by a merging subcluster accelerates an existing population of relativistic electrons, producing synchrotron emission at radio wavelengths. Previous observations of the Ophiuchus Cluster have detected a radio minihalo near its CC, and a recent observation of the cluster by Werner et al. (2016) revealed a discontinuity in the surface brightness that they attributed to a merger. However, their observation was taken using the *Chandra* X-ray Observatory, whose energy bands are sensitive to absorption from our own Galaxy, making it difficult to measure temperature variations that are the telltale sign of merger activity. This study, therefore, used the Nuclear Spectroscopic Telescope Array (*NuSTAR)*, which operates at higher X-ray energies unaffected by absorption, to search for evidence of a merger, which would support the merger-minihalo connection. Spectra from regions around and inside the discontinuity detected by *Chandra* were fit to a standard emission spectrum to determine the temperature distribution of the region. We find suggestive evidence of hotter gas in front of the potential merging subcluster, consistent with it driving a shock front through the main cluster ICM. In the future, we will confirm these measurements with data from the *XMM-Newton* X-ray Observatory, which covers this same region and can help disentangle the effects of stray light that affect parts of the *NuSTAR* observation.

Poster 28

Presenter: Amanda Adams (The University of Tulsa)
Mentor: Lauren Barth-Cohen (Educational Psychology)
Aspects of Data Analysis in an Introductory Physics for the Life Sciences (IPLS) Laboratory Course

The Next Generation Science Standards (NGSS) for K-12 education propose an active, three-dimensional science education. Students utilize Scientific Practices, such as Analyzing and Interpreting Data, to scientifically investigate the world, which enables students to learn and apply Crosscutting Concepts, such as cause and effect, to achieve understanding of Disciplinary Core Ideas in areas such as the physical and life sciences. The physics education research community has designed Physics for the Life Sciences (IPLS) lecture and laboratory courses with the goal of connecting physics to biology. Though developed prior to the publication of the NGSS, these labs contain three-dimensional learning throughout, intending for students to develop their research skills, including Analyzing and Interpreting Data. As of yet, there is little understanding about how students engage in this practice in IPLS labs. Needed is a more detailed understanding of this practice, which in turn can support the development of research and assessment tools. Our team conducted qualitative analysis of students' lab reports, and audio/video recordings of pilot task-based interviews and of classes, to support the development of a preliminary theory of Analyzing and Interpreting Data that involves the following aspects: data collection, data cleaning, data manipulation, data interpretation, argumentation, mathematization, and utilizing representations. We then analyzed the first semester IPLS lab course at the University of Utah to specify where students engaged in each aspect of data analysis within each lab. These preliminary results supported the design of a task-based assessment to assess students' skills in these aspects. Our team is currently piloting the assessment, where it will be further refined and validated. This assessment, along with other sources of data, will provide insight into, and enable theorization of, how students engage in the process of data analysis in IPLS lab courses at the University of Utah.

Poster 29

Presenter: Atticus Edwards (University of Utah)
Mentor: Brent Kious (Neurology)
Perceptual Knowledge and Cognitive Appraisal in OCD: The Role of Interoception In a New Neuropsychological Model and Treatment Paradigm.

"Cognitive appraisal" models of OCD propound that OCD symptoms arise from maladaptive attitudes toward involuntary thoughts with particular content. This formulation basically agrees with more recent neuropsychological models that take "cognitive biases" to be the cause of OCD symptoms, as opposed to deficiencies in specific cognitive capacities. Cognitive-behavioral therapy (CBT), the frontline treatment for OCD, is based on cognitive appraisal models. While researches have identified the semantic content of numerous so-called appraisals (i.e., how such appraisals are verbally expressed), the precise phenomenal nature of such maladaptive attitudes in relation to the patient's broader phenomenological experience remains unexplored by cognitive appraisal models. Likewise, a positive phenomenological formulation of the clinically appropriate relation a patient ought to have with their involuntary thoughts (obsessions) is virtually absent from existing psychological literature. Drawing from evidence showing disorganization between higher-order cognition and perceptual cognition in OCD patients, I present a reformulation of existing "cognitive bias" models of OCD. In my interpretation, OCD patients don't know how to trust perceptually apprehended knowledge of the world as a legitimate basis for assurance about their daily life; instead, they unknowingly consider semantically formulated knowledge to be the predominate legitimate basis for assurance. Maladaptive appraisals thereby amount to a strong

mistrust of interoception: the mind's apprehension of the body, the world around it, and the passage of time. In contrast to the assumption that a pursuit of total certainty about the content of obsessions is a key characteristic of OCD, my model instead interprets this preoccupation with certainty to concern "semantic" or "higher order" assurance, which patients pursue disproportionately only in the absence of assurance otherwise gained via interoception. Finally, I present an innovation on existing CBT methods to help patients reappraise their interoception as reliable.

Poster 30

Presenter: Avery Conner (University of Utah)
Mentor: Keith Koper (Geology and Geophysics)
Analysis of the 2019 Clawson Sequence of Seismic Events in South-Central Utah

Between 13 March 2019 and 27 May 2019, a sequence of over 180 earthquakes occurred on the northwest edge of the San Rafael Swell near the town of Clawson in south-central Utah. The sequence consists of tectonic earthquakes. Due to the remote location and small magnitude of most of the events, the sequence was only lightly felt. The largest event was an M_L3.2 shock that happened on 10 April 2019. Absolute locations consisting of depth, time of origin, and the latitude and longitude for each of the events were determined by analysts at the University of Utah Seismograph Stations using the program HYPOINVERSE in combination with a local 1D velocity model. Using waveform cross-correlation methods to measure differential travel times, we are working to refine the current locations with GrowClust, a cluster-based relative relocation program. Following relocation, we will use template matching techniques with known event waveforms to identify other events that are associated with the sequence but were not initially identified. These results will be used to make inferences about the tectonic structures within the region to better understand the threat posed by earthquakes in Utah. Additionally, the results will be used to determine if the recent Clawson sequence is related to the 1988 M_L 5.3 earthquake that was also located on the northwest edge of the San Rafael Swell.

Poster 31

Presenter: Maxwell Reese (West Virginia University)
Mentor: Caroline Saouma (Chemistry)
Novel Modified Triphos Iron and Cobalt Complexes for Carbon dioxide Hydrogenation

Carbon dioxide (CO_2) is a notorious greenhouse gas made abundant in the atmosphere as a byproduct of combustion reactions. However, CO_2 has the potential to re-enter the energy landscape as a recyclable C1 feedstock chemical *en route* to alternative fuels such as formate and methanol via hydrogenation. Several catalysts presented in the literature are competent to transform CO_2, however they often employ precious metals, strongly basic conditions, and high pressures of H_2 gas. Less expensive first row transition metals that operate under mild conditions are therefore a desirable target. We hypothesize that the addition of second coordinate sphere amines to first row transition metal complexes would increase production of formate and methanol as well as allowing for the use of weaker bases due to metal ligand cooperativity. To this end, the ligand 1,1,1-tris((4,1-(N-methyl)-azaphosphonane)-methyl)-ethane, $^{R}\mathbf{(PN^{Me})_3}$, was used to prepare a catalyst candidate, $Fe[^{R}\mathbf{(PN^{Me})_3}][MeCN]_3[BF_4]_2$. To understand how these pendant amines influence catalysis, suspected catalytic intermediates were synthesized and spectroscopically characterized to aid future mechanistic studies. This poster presents our recent efforts, and contextualizes our findings in terms of potential for feasible carbon capture and recycling.

Poster 32

Presenter: Bailee Alonzo (Texas Tech University)
Mentor: Gloria Slattum (Pediatrics)
Characterization of a Vanishing White Matter Disease Model in Zebrafish

Vanishing white matter disease (VWM) is an inherited leukodystrophy, causing CNS demyelination and high rates of morbidity and mortality. VWM disease is autosomal recessive and is caused by mutations in the five subunits of the eukaryotic translation initiation factor (eIF2B) complex. The goal of this study is to test a zebrafish model of VWM disease in zebrafish for potential therapies, and to gain insight into the mechanism behind mutations in eIF2B disproportionately affecting white matter. We have generated and characterized mutant alleles in zebrafish eif2B subunits 1, 2, and 4, and an allelic series in subunit 5. The eif2B mutants exhibit a range of phenotypic severity, including changes in growth, lethality, behavior, myelination, apoptosis and proliferation in the CNS. To further examine our model, we sought to rescue mutant phenotypes through the GSK3β pathway, which is known to inhibit eIF2B and affect translation initiation. After treatment with the GSK3β inhibitor, lithium chloride (LiCl), we found a rescue in the swimming behavior of eif2B5zcA9/zcA9 mutants. Further, studies show that the eIF2B complex regulates a group of 75 genes when receiving neural signals. In this study, we find a significant down regulation of heat shock protein D1 (hspd1) in both our zebrafish model and a human VWM disease patient. Our data reveals that eIF2B controls an unrecognized hspd1 dependent step in myelin

maintenance which may be important for understanding VWM disease pathophysiology and the predisposition for disease progression. We also show that lithium chloride (LiCl) may be a promising treatment for VWM disease.

Poster 33

Presenter: Htoo Htoo (University of Utah)
Mentor: Anne Kirchhoff (Family & Consumer Studies)
Researchers Experience With Giving Research Results Back to Research Participants

Background: A research participant is an individual who participates in human subject research by being the target of observation or intervention by researchers. It is important to provide information on study findings to research participants because it helps participants feel involved in the study and enhances their engagement in the research process. However, few studies have been done on the practices of researchers sharing research results with their participants. **Purpose:** In this research we had two purposes. The first was to evaluate some of the concerns and barriers researchers have when giving feedback on study results to participants. The second was to understand the methods researchers use to give results back to research participants. **Methods:** We did Literature search in PubMed with key words such as participant feedback, research results, research finding, and data sharing. We also reviewed the reference list of articles for other articles. Out of the 15 articles we identified, only 9 were related to our topic. The team then developed a survey based on the articles we read. The survey content included questions regarding barriers and concerns of researchers when giving feedback to participants, and methods researchers use when giving results back to research participants. We created the survey in RedCap. During July 2019, we sent the survey to 22 researchers who work with research participants at the Huntsman Cancer Institute/University of Utah Health Sciences. Out of the 22 researchers, 15 (68%) completed our survey. **Results:** Of the 15 participants, 71% reported that they typically share research results with participants; 79% felt it was extremely important to important to share findings with participants. A total of 100% stated that they believe research participants want to know about research findings. Participants reported barriers to providing feedback to participants that included: Providing feedback takes too much time/energy (40%), there is not enough grant budget to do this (53%), and I don't know the best way to provide feedback (73%). Write in responses of barriers included that it can be challenging to frame the results as to not appear negative or fearful and that often time contact information on subjects is removed before results are finalized. Most researchers stated the best time to provide research results to participants was after the publication of manuscript (43%). Participants indicated that mail (53%), email (67%), and website (47%) would be the most effective ways to provide feedback. Researchers consider factors such as education (67%), ethnicity (40%), and language (73%) when developing ways to give participant feedback. **Conclusion:** Researchers do believe it is important to share research findings with participants and generally feel like their participants want to know about study findings. Barriers of researchers when giving results back include cost, the amount of time, and not knowing the best way to give feedback. It is typical to provide results after manuscripts are published. Our study indicates that researchers consider using many different strategies when giving feedback including mail, email and website development. Most researchers consider factors such as participant education, ethnicity and language spoken when providing feedback. When researchers give results back they should make sure the participants receive the results, that they understand them, and that the results do not affect them in a negative way. **Future Research:** Next steps for this research would be to ask the participants if they want their results back or not and if they do, how do they want the results to be delivered: in mail, email or in person. We need to get opinions from both researchers and participants if we want to find a better way for researchers to share findings with participants. This would help to enhance people's engagement in research and in the future, there would be more participants in research studies.

Poster 34

Presenter: Ashley Holiday (Dixie State University)
Mentor: Kalani Raphael (Internal Medicine)
Effect of bicarbonate on fibroblast growth factor-23 in chronic kidney disease

Fibroblast growth factor-23 (FGF23) facilitates urinary phosphate excretion. In chronic kidney disease (CKD), FGF23 levels increase to maintain normal serum phosphate. Higher FGF23 levels are associated with cardiovascular disease in CKD. In animal models, metabolic acidosis increases FGF23 levels. However, the association between serum bicarbonate levels and the effect of treatment with sodium bicarbonate on FGF23 in humans is unclear. To determine the association between serum bicarbonate and intact (i) FGF23 we performed a linear regression analysis adjusted for estimated glomerular filtration rate (eGFR), age, and serum phosphate levels in 174 individuals with CKD. To determine the effect of sodium bicarbonate on iFGF23, we analyzed data from a randomized, placebo-controlled trial of 74 patients with CKD, 35 were treated with sodium bicarbonate and 39 received placebo. In the cross-sectional study of 174 individuals, mean±SD characteristics were age 66±12 years, eGFR 44±17 mL/min/1.73m2, serum bicarbonate 23±3 meq/L, and iFGF23 23±17 pg/mL. Each one meq/L increase in bicarbonate was associated with a non-significant lower iFGF23 (-0.3, 95%CI -0.4 to -0.1 pg/mL). The mean±SD of the 74 participants in the randomized controlled trial were age 72±8 years, eGFR 52±18 mL/min/1.73 m2 and serum bicarbonate 24±2 meq/L. Over 6 months, iFGF23 increased in the placebo group 13% (95% CI 1% to 12%) but did not change in the sodium bicarbonate group (1% increase, 95% CI -10% to 12%).

Serum bicarbonate is not associated with iFGF23 in CKD. However, sodium bicarbonate treatment may attenuate the increase in iFGF23 observed in CKD patients.

Poster 35

Presenter: Bojana Ivanic (University of Texas at Dallas)
Mentor: Sarah Li (Physics & Astronomy)
The Influence of Grain Structures on the Optical and Spin Properties of $MAPbI_3$ Film

Spintronics is a field of electronics that focuses on the behavior and properties of spins rather than that of electrons. Semiconductor spintronic devices are expected to operate at smaller sizes, higher frequencies, and lower power than their electronic analogs, as well as perform operations impossible for purely electronic devices—a spin-based processor would be able to perform logical operations and store memory all at the same time. To realize these devices, we need to preserve electron spins for a long time and efficiently manipulate them. For most materials, it is a tradeoff between long spin lifetime, which favors low spin-orbit coupling (SOC), and easy spin manipulation, which requires high SOC. Hybrid perovskites, a new class of semiconductor, are promising for spintronic applications as they have both attributes. Long spin lifetime has been demonstrated in polycrystalline methylammonium lead iodide ($MAPbI_3$) film, but the influence of microstructures on this property has not yet been investigated. Large SOC effects have been predicted, but no strong experimental evidence has confirmed the spin textures. This project studies the influence of grain structures on the optical and spin-dependent properties of $MAPbI_3$ films. A large grain sample of $MAPbI_3$ was imaged with reflectance and photoluminescence (PL) measurements using a scanning microscope. Grain boundaries can be seen in both the reflection and PL images, and subgrain structures can be seen by comparing the two. We found that the PL peak shifts across the sample, indicating nonuniformity of the polycrystalline film. Understanding the origin of these properties and the behavior of spin within perovskite films is necessary so that materials can be optimized for spintronic applications. This project is ongoing, and this setup will be used to study the influence of grain structure on spin dynamics in $MAPbI_3$ films, as well as SOC effects on high quality single crystals.

Poster 36

Presenter: Caitlin Gallivan (University of Utah)
Mentor: John Pleinis (Human Genetics)
VPS33B is Required in the Drosophila Tubule and Hindgut for Normal Excretion

Arthrogryposis-renal dysfunction-cholestasis (ARC) syndrome is a rare and fatal genetic disease in which affected individuals rarely live past infancy. This disease is accompanied by several severe phenotypes including renal tubular dysfunction. It has been shown that ARC Syndrome patients possess genetic mutations in either the Vacuolar protein sorting-associated proteins 16B or 33B (*VPS16B* and *VPS33B* respectively), but how these genes affect renal tubular function is unknown. Our lab uses the fruit fly, *Drosophila melanogaster*, to study pathways relevant to mammalian kidney function in the *Drosophila* renal system. *VPS16B* and *VPS33B* are conserved in *Drosophila*, and we hypothesized that they are important for fly renal function. In order to test this hypothesis, we employed the "poop-drop assay" to evaluate excretion in *Drosophila melanogaster* in which we knocked down *Drosophila Vps16B* and *Vps33B* in different parts of the fly excretory system. Using the GAL4/UAS-RNAi system, we knocked down our genes of interest in either the Malpighian tubules or the hindgut, the two parts of the fly excretory system, and measured excretory ("poop") drops per fly. We fed the flies either a normal diet or a diet supplemented with high salt (0.3 M NaCl). Here we report that there is no significant excretion phenotype when *Vps16B* is knocked down in the hindgut or in the tubules. However, *Vps33B* knockdown males express a reduced excretion phenotype with *uro-GAL4*, which is localized in the tubule, when fed high salt fly food. Furthermore, we observe a significant increase in excretion in *Vps33B*/*c601* females exposed to normal fly food. The *c601-GAL4* is expressed in the hindgut. Collectively, our data suggest that the VPS33B protein affects excretion and functions in both the tubule and hindgut, while VPS16B has not been proven to play a significant role in either tissue.

Poster 38

Presenter: Johnny Rodriguez (University of Utah)
Mentor: Claudia Geist (Sociology)
Social and Economic factors: The Influencers of Contraceptive Effectiveness (proposal)

This research project seeks to identify the convergence of social and economic factors when it comes to defining the type of contraceptive method used by consumers, and how this varies by different groups. The type of contraceptive methods differentiating in effectiveness and time disposable. When social and economic factors are seen as 'barriers', or of lower level, the type of contraception will be less effective and of shorter time use. When they are not 'barriers', or of higher

level, the type of contraception will be more effective and of longer time use. The first part of the project analyzes independent pieces of literature to determine what factors are considered barriers and which are not. That criteria are then carried over to analyze survey data from the HER Salt Lake initiative. A study that collected data on the contraceptive choices of women in the state of Utah. The final goal is provide material that is helpful towards challenging issues of accessing a wide span of contraceptive choices for all consumers.

Poster 39

Presenter: Madeline Meyer (Ohio Wesleyan University)
Mentor: Cynthia Burrows (Chemistry)
Comparing DNA i-Motif Folding Methods

The i-motif is a DNA structure that may play a role in gene regulation and at origins of replication. This fold is held together by shared imino protons between base-paired 2′-deoxycytosines (2′-dC), thus it can form under mildly acidic conditions when a DNA sequence contains at least four runs of 2′-dC in close proximity. Circular dichroism (CD) was used to compare methods commonly used to study the pH-dependency of i-motif fold transitions: (1) rapidly folding the DNA by directly injecting it into a buffer with the pH of interest, (2) rapidly folding DNA at a low pH and slowly titrating to higher pH, and (3) starting at a high pH, titrating slowly to a lower pH to slowly fold the DNA. To explain isothermal hysteresis during pH-dependent structural transitions occurring during slow titrations, thermal melting curves from DNA samples titrated from high to low and low to high pH were analyzed for free energy, enthalpy, and entropy values. Here, CD spectra and thermal melting curves with analysis are shown for several model i-motifs. Understanding the folding of these molecules will help clarify the stability and roles of i-motifs that form *in vivo.*

Poster 40

Presenter: Jordan Swanier (Xavier University of Louisiana)
Mentor: Aaron Quinlan (Human Genetics)
Using CRISPR/ Cas9 for Target Enrichment and Long Read Sequencing to Genotype Medically Relevant Genes

Amyotrophic lateral sclerosis (ALS) is a progressive neurodegenerative disease that affects nerve cells in the brain and the spinal cord. Many cases are genetic in origin and the most common genetic cause is a (CCCCGG)n repeat expansion in the *c9orf72* gene, which accounts for up to 40% of familial ALS. Due to the repetitive nature of this intronic region, it is not sequencable with short read technologies. However, long read sequencing technologies can span the entirety of the repeat expansion, allowing for complete resolution of the repeat sequence. Using a modified CRISPR/Cas9 method, our goal is to create a framework to sequence difficult to access, yet medically relevant genomic regions for personalized genomic medicine. Our current focus is the *c9orf72* repeat expansion, which, when enriched, can then be sequenced at high coverage with Oxford Nanopore long-read technology. There are a multitude of *in silico* gRNA selection tools that can be used to optimize the gRNA. Most gRNA selection tools are designed for gene editing purposes, and strive to minimize off-target affinity. However, for our target enrichment strategy, we seek to identify gRNAs that maximize on-target efficiency and minimize self-complementarity. Therefore, we must evaluate the many gRNA selection tools for this new purpose. By comparing results from in silico selection tools, we evaluated the relevance of the various scoring schemes. We tested guides predicted to maximize enrichment for the *c9orf72* repeat expansion and compared the predicted efficiency to the observed enrichment at the *c9orf72* locus.

Poster 41

Presenter: Samantha Enos (University of New Mexico)
Mentor: Nicole Mihalopoulos (Pediatrics)
Physical and Mental Health of Transgender Adolescents

Transgender/gender non-binary (TNB) adolescents (gender identity that is incongruent with the sex assigned at birth) experience discrimination and stigma, which may lead to poor health outcomes. We examined 3 health outcomes (body mass index [BMI], self-harm and suicidal ideation within 3 months before each visit) of TNB patients at an Adolescent Medicine Clinic. We randomly selected and reviewed charts for 25 transmales and 25 transfemales with at least 3 visits from May 2017-May 2019 to abstract the 3 outcome variables, and identified if they were taking puberty blockers, and/or gender-affirming hormones. We performed descriptive statistics, paired t-test, and Fisher's exact test to compare visits 1 and 3. For transmale patients at visits 1 and 3: mean BMI was 25.9±8.6 vs. 26.7±8.3 ($p=.01$), self-harm was noted for 5 and 8, and suicidal ideations for 8 and 6 patients, respectively. For transfemale patients at visits 1 and 3: mean BMI was 21.1±6.0 vs. 21.5±5.8, self-harm and suicidal ideations described for 2 and 3 patients. Puberty blockers were used by 16% of transmales at both visits, while 16% and 60% used hormones at visits 1 and 3, respectively. Additionally, 44% of transfemales used puberty blockers at visit 1 and 76% at visit 3, while 32% and 52% used hormones at visits 1 and 3. Transmale patients had greater BMI that increased significantly between visits 1 and 3, and worse mental health compared to transfemales. Further research is needed to determine whether BMI and mental health outcomes were affected by puberty blockers or hormones.

Poster 42

Presenter: Liz Mulvey (St. Mary's College of Maryland)
Mentor: Shanti Deemyad (Physics & Astronomy)
AC Magnetic Susceptibility of Lead under Extreme Conditions

Superconductors, materials with exactly zero electrical resistance and perfect diamagnetism, have widespread potential applications in transportation, medical imaging, and general technological advances. To facilitate their expanded use, our lab studies high pressure and low temperature conditions that cause the transition from a normal conductor to a superconductor. For detection of superconductivity in tiny samples under pressure, we design and calibrate micro-coils. A diamond anvil cell (DAC) is used to incrementally compress the lead sample to from about 0 to 5GPa. The system is then placed inside a cryostat where the anvil and sample are cooled down to ~2K. Taking advantage of the fact that superconductors repel magnetic fields, a set of magnetic micro-coils is used to detect the lead's transition to superconductivity. The micro-coil system consists of an outer coil that introduces a magnetic field and an inner coil to detect if any of the field has been expelled. An additional set of coils is placed under the same conditions but without a sample enclosed to detect any background field and ensure that readings can be safely attributed to changing properties of the lead. Lead's transition to superconductivity was observed at about 6K and 2GPa. Multiple trials were conducted to thoroughly map how pressure versus temperature induces superconductivity. Future research should involve crystallographic analysis of various samples with unknown superconducting properties under the same range of temperature and pressure conditions to investigate the relationship between a material's structure and its physical properties. Using machine learning to understand this relationship further could provide opportunities for synthesizing custom materials with predetermined properties. This ability to design materials for a system, rather than designing the system around materials, will advance many areas of technology.

Poster 43

Presenter: Andrea Palos-Jasso (University of Mount Olive)
Mentor: Sujee Jeyapalina (Surgery)
Micro-Patterned Silicone Surfaces Limit Capsular Thickness Around Breast Prostheses

Breast prostheses are often accompanied by clinical complications such as bacterial infection (~2.4-16%) or capsular contracture (CC; ~7.6-40%) formation and result in pain and discomfort to the patients. The formation of CC has been attributed to bacterial colonization, either on the surface of the implant or within the surrounding capsule. Thus, it was realized that the use of antibacterial eluting implants or surfaces that deter bacterial adhesion could circumvent this adverse outcome. Sharklet™ surfaces that mimic shark skin denticle patterns are known to deter bacterial adhesion and biofilm formation. Therefore, it was hypothesized that similar micropatterns would limit bacterial adhesion, and in turn, CC thickness around implants. In order to test this hypothesis, 10 mm diameter silicone implants with 3X3, 5X5, and 10X10 micropatterns, in addition to a non-patterned control implant, were fabricated. Efficacies of these designs to limit CC formation were tested in a rat model; where twelve Sprague Dawley rats were divided into 4 groups. During the implantation surgery, a longitudinal incision was made parallel to the spinal column, and a subdermal pocket was made on the opposite side of the spine by blunt dissection. A single implant (i.e., 10X10, 5X5, 3X3, or smooth control) was then inserted into this pocket, which was then inoculated with Staphylococcus aureus (3.0 x 104CFU). The incision line was closed, and animals were allowed to ambulate for 12 weeks. At necropsy, the implants and adjacent tissues were collected, fixed with 10% formaldehyde, embedded in PMMA, sectioned, polished to optical finish, and then histologically analyzed. The CC thickness data revealed that 3X3 and 5X5 groups had significantly thinner capsules ($p<0.05$) when compared to the smooth control group, which supported the tested hypothesis. It was therefore concluded that micropatterns could be used to prevent thicker CC formation around breast prostheses.

Poster 44

Presenter: Barrett Johnson (University of Utah)
Mentor: Keith Koper (Geology and Geophysics)
Analysis of the 2019 Bluffdale Earthquake Sequence

On February 15, 2019, an Mw 3.7 earthquake occurred near the city of Bluffdale, Utah and was widely felt throughout the Salt Lake Valley. The University of Utah Seismograph Stations (UUSS) detected and located 191 earthquakes in the Bluffdale region between February 5 and April 15; 13 foreshocks and 178 aftershocks. Using the UUSS catalog, waveform data was collected for each earthquake at each station within a 50km radius (36 stations total) from IRIS, to perform waveform cross-correlation. TauP, a seismic time calculator, was used to create a local 1-D velocity model to measure the theoretical P-phase and S-phase arrival times for each station per event. Using these P and S arrival times, cross-

correlation coefficients and differential travel times were calculated for each event pair. From the 18,145 event pair combinations, our specialized program produced approximately 934,000 correlations and differential times which were then input to GrowClust. GrowClust, a hierarchical clustering algorithm designed to relocate earthquakes based on waveform similarity, relocated 190 of the 191 original catalog locations. The initial results show the focal depths confined to a range from 6 to 7.6 km; the shallower relocations are to the southwest and the deeper events located towards the northeast. Complex tectonic structures and secondary fault systems near Bluffdale explain the peculiarity of the fault strike and dip direction, as there are many antithetic faults juxtaposed with the typical, normal-faulting of the Basin and Range Extensional Province. This study will allow the UUSS to more precisely estimate recurrence intervals and educate the public of earthquake hazard and preparedness.

Poster 45

Presenter: Meghan Rainier (California Polytechnic University)
Mentor: Ryan Looper (Chemistry)
Aminonapthaquinone Analog's to Achieve Higher Antibiotic Binding Affinity

Resistance to the antibiotics on the market today are expected to continue to increase over the next 20 years. The development of new antibiotics and their use against binding sites in the ribosome is one possible method of improving the antibiotics. Many of the current ribosomal antibiotics attack the A-site of the ribosome. The antibiotics that target this location have been discovered, developed, and are now gaining strong resistance. Our research group is currently focused on finding molecules that target the P-site instead of the A-site of these ribosomes using a molecule with a similar core structure to that of a Fluoroquinilone, called an Aminonapthaquinone. This allows for the potential development of small molecules that bacteria have not yet developed resistant to. Past research has already shown that A-73210, an analog of the Aminonapthaquinone starting material, has a higher binding affinity to a combination 70S ribosome of subunits Thermus thermophilus 50S and E-coli 30S. The goal of the current research is to use combinatorial and parallel synthesis methods to find an analog of the Aminonapthaquinone molecule with higher binding affinity to the P-site of the 70S ribosome to ultimately improve the Aminonapthaquinone's binding affinity to the ribosome's P-site.

Poster 46

Presenter: Sierra Penn (Haskell Indian Nations University)
Mentor: Angie Fagerlin (Population Health Sciences)
How Parents who have a Fetus/Neonate Diagnosed with A Life-Threatening Congenital Heart Defect Make Treatment Decisions: The Importance of Quality of Life

Parents with a fetus/neonate diagnosed with a life-threatening congenital heart defect are confronted with making the time-sensitive decision of choosing between terminating the pregnancy, comfort care, or surgery. The purpose of this qualitative study was to understand how parents made this challenging treatment decision. Ten focus groups were conducted in Salt Lake City, Chicago, Durham and Washington, DC with 5 groups composed of parents who pursued surgery and 5 groups of parents who chose comfort care or termination. Transcripts were coded using content analysis to identify key themes. How parents approached the treatment decision and what mattered most to them in the decision-making process varied. One of the most prominent themes was about quality of life for the family and their fetus/neonate. More specifically, parents discussed financial circumstances (e.g, health insurance, income) and the impact of the decision on marriage and their other children. Additionally, parents varied considerably in what quality of life of their fetus/neonate meant to them, key quotes included: "showing the baby what love was," "taking it day by day because it could change tomorrow," "having their child experience the typical life of a child," "spreading the same amount of love to every child", or "knowing that there baby did not suffer." Finally, parents often expressed that they wished they have more information and resources when making the decision.Future research needs to develop and test methods for improving parent knowledge and decision making.

Poster 47

Presenter: Chris Howard (University of Utah)
Mentor: Christoph Boehme (Physics & Astronomy)
Studying the effects of electric fields on the magnetic resonance line width in photoluminescence-detected magnetic resonance spectroscopy in conjugated polymers

Electrons in a π -conjugated polymer are highly mobile around a single polymer chain and when such a polymer is used as active layer of an organic light emitting diode (OLED), the application of an electric field will induce charge carrier recombination. Charge carrier recombination is an electronic process where an electric current consisting of negative electrons and positive holes that are injected into the polymer, leads to, first, a formation of electron-hole pairs and then, second, to a decay of these pairs in the course of which both charge carriers annihilate. Charge carrier recombination is the primary means by which OLED devices produce light. Since spin selection rules delay recombination after the initial excitation of the sample, we can monitor the fluorescence through optically detected magnetic resonance spectroscopy,

where magnetic resonance influences electron and hole spin states and subsequently, the recombination current is changes due to the spin-selectivity of the recombination process. We conducted optically detected magnetic resonance on organic thin-film capacitors to study the effects of external electric fields on the spectral line width of spin-dependent recombination rates. The samples are capacitors with thin films of the conjugated polymers Poly[2-methoxy-5-(2'-ethylhexyloxy)-p-phenylene vinylene] (MEH-PPV) as the dielectric to which we apply an external electric field ranging from 0V to 150V per active layer thickness, which is approximately 100nm to 150nm. These capacitors are photo-excited with 30mW of light from a 405 nm laser, and the photoluminescence is detected under magnetic resonance at an excitation frequency of 128MHz and plotted against a field sweep centered around 48G. We graphed the optically detected magnetic resonance signal as a function of the electric field applied to the capacitor plates, to study the effects of the electric fields on line width, which implies the delocalization of charge-carrier pair interactions.

Poster 48

Presenter: Alec Parent (University of Utah)
Mentor: Aakanksha Saha (School of Computing)
Research Platform for Studies using Sensors

Purpose: This SPUR project focused on software to help researchers monitor sensors when they are used with study participants. Background: Software engineering was an integral part of the overarching study research aims. Sensor-based monitoring has been emerging as a tool for health-related research. Tiny sensors can continuously record aspects of a person's behavior, as well as their environment and social context. Sensors in consumer electronic devices and "wearables" like fitness trackers can provide important information for health researchers. Including sensor information in research is a complex task, however. The Study: The Utah PRISMS Informatics center was funded by NIH to create an infrastructure to support using sensors as part of pediatric asthma research. This project was part of one key component of that infrastructure. Research Activities: I learned about health related research, and about research that combines informatics, human-computer interaction, and software engineering. I was able to practice my programming skills and learn new aspects of software engineering.

Poster 49

Presenter: Jacob Bedke (University of Utah)
Mentor: Trafton Drew (Psychology)
Long-Term Memory and Neural Components of Visual Working Memory

When we search for an object within our environment, we have a mental representation of that object to compare to the sensations that we derive from our environment in order to identify the object we are looking for. This mental image is thought to be found in systems involved in visual working memory and is known by visual search researchers as an 'attentional template' (Carlisle et. al., 2011). While investigating the attentional template in previous research, we found differences in the electrophysiological signals between objects having complex details (real-life stimuli) and simple, artificial stimuli such as Landolt Cs. To address the question as to why these differences exist, the current study seeks to elucidate how previously existing, long-term memories of objects might impact the attentional template through methods of electroencephalography (EEG) as well as behavioral performance. To do this, participants memorize a set of objects and attempt to recognize these objects among distractor objects. While measuring electrophysiological signals, participants perform a visual search task where participants are briefly shown an object. Once the object disappears, they are required to indicate whether that object is present or absent in a search array. Some of the objects that participants search for are novel objects that are never encountered prior to the search, while other objects were present in the previous tasks to be memorized and recognized. Given that a participant to recognized previously shown objects, we can infer that they formed a long-term memory of these objects that may impact the attentional template representation during the search task. We, then, compare different event-related potentials (ERPs) between object conditions to infer how having a long-term memory of an object affects the attentional template while searching for that object. Reference: Carlisle, N. B., Arita, J. T., Pardo, D., and Woodman, G. F. (2011). Attentional templates in visual working memory. J. Neurosci. 31, 9315-9322.

Poster 50

Presenter: Emma Thornton (Utah State University)
Mentor: David Viskochil (Pediatrics)
Guidelines of Care in Prader-Willi Syndrome Multi-disciplinary Clinics

Introduction/Background: Prader-Willi syndrome (PWS) is a complex, multi-system disorder affecting approximately 1/15,000-1/30,000 individuals. The complexity of the disorder along with the numerous medical needs of individuals with PWS entails the implementation of a multidisciplinary approach for the care of these individuals. We hypothesize that a set of guidelines, if used by most multispecialty clinics, would provide optimal care for individuals with PWS. The main research aim of our study is to assess the practical implementation of care for multispecialty PWS clinics, and document impeding challenges. We started this process by assessing the use of guidelines in multi-disciplinary clinics

affiliated with Prader-Willi Syndrome Association-USA (PWSA-USA). Methods: We contacted PWSA-USA and received the contact list of clinics specializing in PWS, most recently updated in March of 2017. We asked those contacts for age-dependent guidelines of care, invited the contact to share the guidelines, and requested comments on the specific utility of the guidelines. Results: We found 9 multispecialty clinics with a care coordinator and email address to follow up with an email invitation to share information. After a ten-day response period, 5 of the contacts gave the requested information. We determined that each of the responding clinics use different guidelines: 3 utilize published guidelines (Duis et al, 2018; AAP Health Supervision for Children with Prader-Willi Syndrome, 2011; IPWSO Website, 2019), and 2 use independent specialty-specific guidelines. The guidelines range from 2011 to 2019 in publishing date. One of five clinics responded with comments on utility of the guidelines for care that they use. Conclusions: The multispecialty PWS clinics throughout the United States generally use independent guidelines to direct the care of individuals with PWS. We propose that regular discussion sessions surrounding specific standards of care at the PWS National Conference, and collaboration through online portals will facilitate a community of care.

Poster 51

Presenter: Alex Guzmán (University of Puget Sound)
Mentor: Andrew Roberts (Chemistry)
Chemoselective Macrocyclization of Tyrosine and Tryptophan Containing Peptides

The field of therapeutic peptides has recently gained significant interest in both the medicinal and chemical communities due to the benign characteristics of peptides as bioactive molecules. Therapeutic peptides exhibit relatively low toxicity and effective binding activity compared to their small molecule counterparts. However, therapeutic peptide development has been hindered by metabolic peptide degradation and unrestricted conformational structure. Studies have shown that macrocyclic peptides, peptides with a cyclic structure of 12 or more atoms, provide both conformational stability and reduce metabolic degradation rates. Although several macrocyclization techniques have been developed, current methods face several limitations: namely, amino acid side-chain incompatibility, introduction of non-native residues, and non-chemoslective reactivity. This research aims to develop a general method for forming macrocyclic peptides by utilizing the reactivity of the highly electron-rich amino acids, tryptophan (Trp) and tyrosine (Tyr), with triazolinediones (TADs). Both Trp and Tyr have been shown to react chemoselectively with TADs in the context of conjugation reactions. The Roberts Lab seeks to extend TAD conjugation chemistry to the context of macrocycle peptide synthesis because the chemistry is compatible with amino acid residues, chemoselective, and forms a peptidomimetic architecture. The Roberts Lab has successfully formed Tyr-TAD macrocyclic peptides but Trp-TAD macrocycles have not yet been pursued. Consequently, this project primarily explores Trp-TAD reactivity with the goal of synthesizing Trp-TAD macrocycles. Tyr and Trp selectivity experiments are also explored.

Poster 52

Presenter: Kellsey Ly (University of Utah)
Mentor: J. David Symons (Nutrition and Integrative Physiology)
Late-in-life treadmill-training ameliorates the decline in cardiac autophagy associated with aging in mice.

Evidence for an age-associated decline in cardiac autophagy is not consistent. We hypothesized that 24-month old male mice (old) exhibit myocardial dysfunction, repressed autophagosome formation in the heart, and reduced exercise capacity vs. 6-month old male mice (adult; n=10 per group). First, left ventricular mass was greater, and indices of systolic, diastolic, and global left ventricular function were impaired in old vs. adult animals. Second, cardiac lysates from old mice displayed reduced accumulation of LC3II / GAPDH and degradation of p62 vs. adult animals. Third, ubiquitinated protein aggregates were more abundant in myocardium from old vs. adult mice and this finding was substantiated using electron microscopy (EM). Fourth, the lysosomal acidification inhibitor chloroquine (CQ) induced accumulation of LC3II / GAPDH and p62 in hearts from adult but not old mice. Finally, maximal workload performed during a treadmill-test, and soleus muscle citrate synthase (CS) enzyme activity, were less in aged mice. Next, in additional cohorts of older male mice, we discerned the impact of late-in-life exercise training. Mice completed a treadmill-running program (old-ETR) or remained sedentary (old-SED) from 21-24 months (n=10 per group). Compared to old-SED mice, old-ETR animals achieved: (i) greater maximal workload on an acute treadmill test; (ii) higher soleus muscle CS activity; and (iii) improved body composition, substantiating the efficacy of the training program (all $p<0.05$). Further, relative to old-SED mice, old-ETR mice exhibited indices of improved systolic, diastolic, and overall myocardial function, greater basal autophagy and autophagic flux in the heart, and heightened clearance of ubiquitinated proteins that was supported via EM in cardiac sections (all $p<0.05$). These data are the first to demonstrate that myocardial function, indices of basal cardiac autophagy, autophagic flux, and ubiquitinated protein clearance, are improved in mice that complete late-in-life exercise training.

Poster 53

Presenter: Jeri Garfield (Dine College)
Mentor: Deanna Kepka (Population Health Sciences)
HPV Vaccination Perceptions Among Health Care Teams in Rural Western Settings

Human papillomavirus (HPV) is a common virus among the human population. It is also known as a sexually transmitted infection that causes HPV-related cancers among 12,000 men and 20,000 women each year in the United States. According to the Utah vaccine registry data, it is reported that rural teens are 1.8 times likely to have a missed HPV vaccine opportunity than urban teens. Little is known about health care team challenges in implementing the five evidence-based strategies: presumptive recommendations, standing orders, provider prompts, patient reminder systems, and Plan-To-Do-Study-Act cycle, to improve HPV vaccination receipt among adolescents in their practices. This study assessed knowledge and attitudes towards HPV infection and vaccine, experienced issues in introducing the HPV vaccine and patient reminder updates to get the HPV vaccine. This study took place at five health care clinics within the rural western settings in the states: Utah, Colorado, Arizona and Montana. Five focus groups were conducted with a total of 78 health care providers. A qualitative content analyses was employed to identify key themes from transcribed focus group summaries. The key themes were categorized as intrapersonal, interpersonal, organizational, and community levels into a similar socio-ecological framework. The networks for HPV vaccine intervention strategies is needed to improve low HPV vaccinations within the rural and underserved populations. The importance of recommending the HPV vaccine is to expand and adapt the HPV-related guidelines for health care clinics within the rural western regions.

Poster 54

Presenter: Madison Putich (University of Utah)
Mentor: Anandh Velayutham (Nutrition and Integrative Physiology)
Effect of dietary blueberry on vascular function in aged C57BL/6J mice

Aging is a major risk factor for cardiovascular diseases such as atherosclerosis, which are major causes of disability and mortality in the elderly. Endothelial dysfunction plays a major role in aging-associated vascular complications. Dietary change may be one of the novel strategies to ameliorate endothelial dysfunction and aging-associated complications. Our lab recently showed that dietary supplementation of blueberries improves vascular inflammation and dysfunction in diabetic mice. In our present study, we investigated the effect of dietary blueberries on vascular function in aged mice. Adult male mice (two months old) and old male mice (17 months old) were fed a control rodent diet (Y and O respectively). The subgroups of Y and O mice were fed a diet supplemented with 3.8% freeze-dried blueberries (Y+BB, O+BB respectively) for 15 weeks. Based on normalization to body surface area, this dose in mice is equivalent to ~1.5 servings of blueberries (~240 g) in humans. Mesenteric arteries were collected and used to assess vascular function using a wire myograph system. After arteries were precontracted to ~65% of maximal phenylephrine-induced contraction and tension was stable, responses to acetylcholine (ACh, 10-8-10-6 M) were evaluated to determine endothelium-dependent vasorelaxation. In our study, there is no difference existed between Y vs. O and O vs. O+BB indicating the vascular function was similar among the groups. Our ongoing studies are focused on identifying the effect of dietary blueberries on vascular inflammation in aged mice and the possible molecular mechanisms involved.

Poster 55

Presenter: Kameron Goold (University of Utah)
Mentor: Gail Zasowski (Physics & Astronomy)
Using magnesium and iron to constrain evolutionary models of the Milky Way

All the carbon, nitrogen and oxygen atoms in our bodies were created by long gone generations of stars. We can better understand ourselves and where we come from by studying the origins of the Milky Way and the history of its star formation. Depending on the mass of a star some will end their life in a powerful supernova, creating new elements and spreading their remains back into the galaxy to be used in the formation of the next generation of stars. In my work, we measure the signatures in stars of two chemical abundances -- magnesium and iron -- that are created in different amounts by two distinct types of supernova. We develop a method to quantify the relationship between these abundances to study the history of stars in our galaxy. Using these quantifiable measurables we can analyze differences or similarities in spatially distinct regions of the galaxy. We then compare results from chemical evolution simulations to our observations from the Milky Way to identify parameters that could constrain evolutionary models of the Milky Way.

Poster 56

Presenter: Darshan Shimpi (University of Utah)
Mentor: Edward DiBella (Radiology & Imaging Sciences)
Comparing the Effects of Different Processing Pipelines on Producing Diffusion Metrics

Diffusion MRI is becoming increasingly popular due to its ability to non-invasively analyze and visualize areas of the brain, by tracking the motion of water molecules through tissue tracts. The technique has been used in the analysis of strokes, brain tumors, and white matter diseases, however, suffers from distortions which can alter the metrics utilized in clinical applications. Many post-processing methods, however, exist and are being increasingly utilized in pipeline sequences to generate results and data that are uncorrupted by distortion artifacts. With many pipelines being suggested and utilized, it is pertinent to find the most efficient pipelines and programs that can produce optimal image results. In our work we compare the popularized Human Connectome Project Pipeline, to a recently developed pipeline from the University of Wisconsin-Madison, to test for efficiency in creating diffusion metrics. Testing was done by comparing the reproducibility of each pipeline in generating usable results from incomplete data subsets. Image quality metrics were then used to assess the difference between subset and full data parameter maps. The Wisconsin pipeline illustrated a 3% increase in structural similarity between subset maps and complete maps, along with other improved image metrics when compared to the HCP pipeline. The pipeline also processed data quicker than the HCP pipeline, suggesting a slightly more efficient approach in generating diffusion metrics for research purposes.

Poster 57

Presenter: Skylar Blank (University of Utah)
Mentor: Alex Wade (Chemistry)
Synthesis of VLC-PUFAs relating to Macular Degenerative Diseases

VLC-PUFAs, Very Long Chain Polyunsaturated Fatty Acids (PUFA), are a type of fatty acid that is found in the retina, testes, brain, and thymus. PUFAs are found in the phospholipid bilayer within these particular regions and are thought to play a key role in age-related macular degeneration, the leading cause of blindness in persons over the age of 60. These large non-polar molecules are unique in that they carry two parts of different regions that fit into a phospholipid bilayer, a long skipped alkene section and a long unsaturated hydrocarbon tail. The purpose of our research is to explore the synthesis of VLC-PUFAs in a more sustainable procurement of starting materials and explore the procurement of starting materials in a more sustainable method than natural product isolation. Alternative routes of synthesis are to be looked at with more emphasis on control over the number of alkenes and their positions. The results of this research will be envisioned to make the study of these unexplored molecules more effective and sustainable.

Poster 58

Presenter: Katie Stokes (University of Utah)
Mentor: David Derezotes (Social Work)
Teaching the Neurobiology of addiction to Those Recovering From Substance Use Disorder

In the last 15 years, there has been a surge in the number of medical emergencies and deaths related to opioid overdoses in Utah. With an increase in the magnitude of people seeking treatment, there is a concomitant need to provide a more holistic and efficient curriculum within drug treatment centers. There have been rapid advances in neurobiology which have illuminated cellular mechanisms associated with substance dependence and recovery. We aim to examine the treatment outcomes when education on the neurobiological basis of addiction and recovery is incorporated into the curriculum at the House of Hope Treatment Center. A series of neurobiology group therapy lessons that focus on the neurobiological basis of addiction especially as it relates to trauma and resiliency have been developed for the House of Hope treatment center whose current educational focus in on the psychosocial dynamics of addiction. Piolet data was collected using a qualitative assessment which surveyed participants experiences with the neurobiology group therapy lesson.

Poster 59

Presenter: Hanaa Al-Ajam (Florida Atlantic University)
Mentor: Dipayan Chaudhuri (Internal Medicine)
How Does Knocking out Specific Assembly Factor Genes Affect the Activity of Complex I?

Cardiomyopathy is defined as a disease that weakens the muscle of the heart. Prior research has revealed a reduced functioning of the mitochondrial electron transport chain (ETC) in cardiomyopathies. The ETC is made up of four protein complexes. A series of redox reactions occur throughout the complexes creating a proton gradient across the membrane which drives the synthesis of ATP. Complex I is composed of 45 different subunits, some of which contribute to the assembly of the mature complex. Some of these proteins are mutated or down-regulated in different forms of heart failure. To investigate if their absence inhibits complex I activity, knockout HEK-293T cell lines of specific assembly factor genes were compared to normal cell lines. The mitochondria of those cell lines are isolated, and the protein content of each sample is quantified. Citrate synthase is then used as a marker for mitochondrial mass because of its constant levels within mitochondria. The complex I enzyme is the main entry point of electrons into the ETC. It is responsible for oxidizing NADH to NAD+. To analyze the complex I activity, we measure the speed at which NADH is being oxidized. Pharmacological means are used to measure the specific activity and separate it from other oxidizing mechanisms of

NADH. It is expected that the knockout of assembly factor genes will inhibit the activity of the complex I enzyme compared to the normal cell lines.

Poster 60

Presenter: Karishma Shah (University of Utah)
Mentor: Martin Tristani-Firouzi (Pediatrics)
Disruption of NFATc1 Nuclear Translocation Caused by M527L Mutation

Atrial fibrillation is the most common sustained arrhythmia in clinical practice and causes patients increased risk of stroke and early cardiovascular death. A Utahn family has been identified where the phenotype of early-onset atrial fibrillation segregates with a missense M527L mutation in the NFATc1 protein, an important transcription factor to normal cardiac function. This project aims to identify whether the M527L mutation disrupts the ability of the NFATc1 protein to translocate to the nucleus upon Ca2+ activation. Adenoviral overexpression was used to produce an abundance of wildtype and mutant NFATc1 protein fused to GFP in HL-1 cells. These cells were then incubated for one hour with varying concentrations of isoproterenol to activate the signaling pathway before being fixed. Confocal microscopy was utilized to image these cells and quantify translocation differences between wildtype and mutant NFATc1. This study found significant differences in the trends between nuclear translocation between the wildtype and mutant NFATc1, with the mutant NFATc1 consistently experiencing less translocation upon Ca2+ activation. Reduced translocation could implicate reduced transcriptional activity of downstream gene programs that prevent atrial cells from functioning normally. These results continue to question the cell's ability to regulate NFATc1 nuclear importation and exportation in lieu of the M527L mutation. This abnormal functionality within an atrial model of cardiac cells could provide a starting explanation for the early-onset atrial fibrillation phenotypically identified in the aforementioned family as well as adding to the growing knowledge of gene control over cardiovascular disease.

Poster 61

Presenter: Justis Aderigbigbe (University of Utah)
Mentor: Andy Clevenger (Chemistry)
Mechanism of the Reduction of Ni(II) precatalysts

Compared to other transition metals nickel catalysis offers more accessible catalyst options in terms of price and scope and has been studied for decades now. However, there are still some issues in using nickel as the core metal, from increased catalyst loading which lowers industrial potential to many potential off cycle products. While some Ni sources exist as an active Ni(0) catalyst, many have to be reduced from a Ni(II) state in order to be catalytically active. We are investigating the mechanisms of reduction from precatalyst to catalyst, as better understanding of this fundamental step could elucidate many issues such as low conversion rate or off-cycle products, that may appear through the rest of the catalytic cycle. The reduction of the Ni(II) precatalyst is often completed insitu. This method usually involves adding in the Ni catalyst, starting material, desired ligand, base and/or reducing agent depending on the reaction type, and sometimes heat. However, without performing direct analysis of the catalyst after the reduction, researchers have been assuming the precatalyst was properly reduced based off minimally investigated hypotheses. Without knowing exactly what is reducing the nickel, they are missing the understanding of a fundamental step in their reactions. This study aims to better understand the trends of the reduction for a very common Ni precatalyst, (dppp)NiCl2, to give researchers insight into what different materials, ligands, and/or conditions should be used to effectively prepare their desired catalyst.

Poster 62

Presenter: Tim McFadden (University of Utah)
Mentor: Andrew Roberts (Chemistry)
Manganese Mediated Ring Contraction and In Situ Oxidation; Functionalization of Alkyl Carbon-Nitrogen Bonds

Considering the abundance of nitrogen present within chemical feedstocks, natural products, and pharmaceuticals, the construction of carbon-carbon bonds (C-C) from amine-derived electrophiles (C-N) could be utilized for complex molecule synthesis. However, the strength of an amine C-N bond has hindered the development of transition metal catalyzed methods that involve their direct functionalization via reductive transition metal catalysis. Appropriately activated amines such as diazonium and ammonium salts have been demonstrated to serve as the electrophilic partner in cross-coupling reactions. Alkyl ammonium salts hold potential advantage over their alkyl halide counterparts in that they can theoretically transfer up to four alkyl groups in designed coupling reactions. To date, the use of ammonium salts as 'unconventional' electrophiles in cross-electrophile-coupling reactions have not yet been reported. Herein, we propose a new strategy for the predictable excision of nitrogen from cyclic amine substrates via the reductive cleavage of two benzylic C-N bonds to form a C-C bond and access ring-contracted 1,2-diaryl carbocyclic scaffolds. To better understand the proposed transformation, we developed a Ni-catalyzed system to affect reductive alkyl C-N bond cleavage, demonstrating for the first time the use of ammonium salts in reductive C-N bond cleavage with concomitant C-C bond

formation. While developing the Ni-catalyzed route we discovered a Mn-mediated system that provides reductive C-N bond cleavage of ammonium salts with concomitant C-C bond formation and in situ oxidation. In addition, we have identified a methylating reagent for in situ and chemoselective methylation of tertiary amines under the Ni-catalyzed and Mn-mediation conditions. This understanding will facilitate the development of reactions wherein nitrogen serves to template the construction of challenging C-C bonds.

Poster 63

Presenter: Gem Wilson (New Mexico State University)
Mentor: Anandh Velayutham (Nutrition and Integrative Physiology)
Effects of Blueberry Supplementation on Metabolic Milieu in Aged Mice.

Objectives: Epidemiological and clinical studies indicate that consumption of berry fruits reduce the risk of developing type 2 diabetes by improving abnormal metabolic milieu. In this study, we investigated the effect of dietary blueberry on glucose metabolism in aged mice. Methods: Aged mice (17 month old C57BL/6J male mice from Jackson Lab) fed with a control diet (O) or freeze-dried wild blueberry powder supplemented diet (3.8% in diet) (OB) for 15 weeks. Young mice (2 months old) were used as controls and fed with a control diet (Y) or blueberry supplemented diet (YB). Based on normalization to body surface area, the blueberry dose is equivalent to 1.5 human servings of blueberry (~240 g) per day. Body weight, food intake, fasting blood glucose and glucose tolerance were assessed at the end of the treatment period. Results: Body weight, food intake and fasting blood glucose were similar among groups. Old mice (O) exhibited an improved glucose tolerance compared to young mice (Y). Blueberry supplementation does not alter glucose tolerance in young (YB) or old mice (OB). Conclusion: Blueberry supplementation does not alter glucose tolerance in aged mice. Our ongoing studies will identify whether dietary supplementation of blueberry improve abnormal metabolic milieu in aged mice. Funding sources: Wild Blueberry Association of North America (to ABPV), Native American Research Internship (to GW).

Poster 64

Presenter: Cara Mogan (Susquehanna University)
Mentor: My Helms (Internal Medicine)
The Role of Cystic Fibrosis Transmembrane Conductance Regulator in Cell Migration

Cystic Fibrosis (CF) is a genetic disorder that damages the lungs and digestive system due to disrupted salt and water transport across epithelium. Patients with CF are now living longer as a result of improved treatments that reduce the symptoms of thick mucus and blocked secretion of digestive enzymes. Unfortunately, as individuals with CF age, they are at increased risk of other diseases, such as colon cancer. Colon cancer is 4 to 8 times more likely to develop in patients with CF than the general population. The risk of colon cancer is 11 times higher for CF patients with a history of distal intestinal obstruction syndrome and increases to over 30 times higher for patients who have received a solid organ transplant. To determine if the elevated incidence of colon cancer in CF patients is due to defective cystic fibrosis transmembrane conductance regulator (CFTR) function, a scratch assay was performed on cultured human colon cells. The scratch was imaged every 24 hours for five days. Wound area and cell migration were measured in the presence of 5 μM Forskulin and 500 μM IBMX (a CFTR activator) or 5 μM CFTRi (a CFTR inhibitor). Control and CFTR inhibitor treated cells grew to fill in the wound area by day 3 with an average migration of 55.38 and 63.94 μm^2/24 hours respectively. The CFTR activator treatment group did not completely grow into the space by this time with an average migration of 27.45 μm^2/24 hours and about 70% of the wound area still open on the third day. The cystic fibrosis transmembrane conductance regulator plays an important role in the rate of cell migration and thus cancer progression.

Poster 65

Presenter: Eduardo Terreros (University of Utah)
Mentor: Andrew Roberts (Chemistry)
Reaction tracking by use of Semi-Quantitative Thin Layer Chromatography

Thin Layer Chromatography (TLC) has a well-established role within chemistry and has become an indispensable tool for organic chemists. TLC is a low cost and easy to use method for collecting qualitative data from organic reactions. While development of a Quantitative TLC (QTLC) method has been achieved, the difficulty in acquiring truly quantitative data has led to this method largely being forgotten. Although other analytical instruments the such as High-Performance Liquid Chromatography (HPLC) are standard practice in organic labs, the idea of QTLC is an unknown concept for most organic chemists. The development of a Semi-Quantitative TLC method will provide a quick, low cost method to track organic reactions without the strict analytical methods needed to acquire quantitative data. The use of specialty software and equipment can be restrictive as well as cost prohibitive, thus a low-cost alternative that uses readily available tools

and supplies to gather images of TLC plates and process them into semi-quantitative data is being developed. In order to achieve this, we have constructed a small image gathering box made of opaque acrylic fitted with two 254 nm UV lamps, and a Raspberry Pi Zero W with a camera module to acquire the images. The images are then imported to a PC and processed by a custom built MatLab function. It has been demonstrated that this system can be utilized in the gathering of qualitative data, and work is currently being done to validate semi-quantitative data collection.

Poster 66

Presenter: Andre Benally (Fort Lewis College)
Mentor: Jeremiah Alt (Surgery)
Structural Organization of Collagen in Chronic Rhinosinusitis with Nasal Polyps: A Pilot Study

Chronic rhinosinusitis with nasal polyps (CRSwNP) is characterized by sustained mucosal inflammation, epithelial barrier breakdown, and tissue remodeling. Collagen fiber misalignment has been correlated with disease progression in various cancers and inflammatory conditions. The role of collagen dysregulation with respect to structure, orientation, and expression in CRSwNP-associated tissue remodeling and disease progression, remains poorly understood. Herein, we evaluated the differences in collagen fiber alignment in anterior ethmoid (AE) and NP tissues obtained from patients with and without CRSwNP. A prospective observational study was conducted that included 13 patients: 7 controls and 6 with CRSwNP. Collagen organization was assessed in the AE and NP tissues of patients using two-photon microscopy analyses of hematoxylin and eosin-stained tissues. Collagen fiber alignment was measured in epithelial and submucosal subsites on a scale of 0 (unaligned) to 1 (aligned) using CurveAlign software. Data was analyzed using ANOVA followed by post hoc Tukey's multiple comparison tests. Collagen fiber alignment decreased from the submucosa to the epithelium of the sinonasal tissues in the control tissue ($p = .0006$) but not in the diseased tissue ($p = .1027$). Collagen alignment was significantly decreased in the submucosa of NP tissue compared to AE tissue within patients with CRSwNP ($p = .0162$). Collagen alignment was also significantly decreased in the submucosa between NP tissue compared to healthy controls ($p = .0018$). Collagen structural organization was found to be different between controls and patients with CRSwNP suggesting tissue remodeling may contribute to the pathology of CRSwNP. Further elucidating the role of collagen structural organization in CRSwNP-associated tissue remodeling may help better understand the pathophysiology of CRSwNP.

Poster 67

Presenter: Rejoice Fon (University of Utah)
Mentor: Russell Richardson (Internal Medicine)
Long term effects of Hypertensive Disease of Pregnancy On Vascular function

Hypertensive disease of pregnancy (HDP, - preeclampsia and gestational hypertension), a relatively common pregnancy disorder, is an important cardiovascular disease (CVD) risk factor likely leading to the development of CVD and other diseases in both the mother and baby. In the United States, ≈160,000 pregnancies per year are affected by HDP, implying, ultimately, a substantial increment in the cost of healthcare for these women and their offspring and a consequent reduction in their quality of life. Utilizing pulse wave velocity, to define arterial stiffness, and flow-mediated dilation and passive limb movement, to define endothelial- dependent vascular function, the goal of the study is to determine whether women with a history of recurrent preeclampsia and/or gestational hypertension have an accelerated vascular aging phenotype to shed more light on the pathophysiology of CVD among women who have experienced these forms of HDP. The intent is study 20 exposed women, 10 unexposed women matched for age, and 10 unexposed older women (> 70 yrs). The Utah Population Database (UPDB) was used to identify a cohort of women with (exposed) or without (unexposed) a history of recurrent HDP who delivered their first pregnancy 10-15 years ago. To date 42 women have been identified as exposed women (i.e. including all the HDP), with 10 meeting the eligibility criteria of the study (i.e. experienced preeclampsia or gestational hypertension, but with minimal other comorbidities). Appropriate classification is crucial for this study. Of the 10 eligible women, 4 have responded positively to inclusion in the study and have been consented and the vascular health and function assessments have been scheduled. Recruitment, screening, and, ultimately vascular assessments continue, with the goal to determine if previous HDP causes accelerated vascular aging.

Poster 68

Presenter: Christian Mickelsen (University of Utah)
Mentor: James Curry (Political Science)
The True Impact of Education Funding on Education Outcomes

Education funding, although a primary point of discussion in political campaigns and state legislatures, is too broad of a topic to be truly evaluated. There are other routes worth exploring that could prove much more effective, such as targeted investment in teacher quality, educational programs, and learning materials. By showing the minimal effect spending alone has on education outcomes, the discussion can be reframed into what does impact education outcomes, and then figure out how to effectively and efficiently fund those mechanisms.

Poster 69

Presenter: Angie Gamarra (University of Utah)
Mentor: Sarah Projansky (Film & Media Arts)
Comprehensive Analysis (History, Present, & Future) of Title IX's Role in Addressing Sexual Misconduct on University Campuses

This project looked at mainstream media coverage and feministic logics starting from 1972 - present to identify best practices based on careful analysis, precedent, and the day to day experiences of Title IX coordinators. We investigated and analyzed court arguments that use Title IX to protect against sexual misconduct as well as did a parallel search on Office of Civil Rights (OCR) documents to comprehend the parameters of Title IX's role in protecting against sexual violence on university campuses. Victim advocacy/appropriate aid and transparency in university policy is the core of this research. This research exposed us to current strategies universities use to address sexual misconduct but also made us more sensitive and aware of Title IX rules currently being in transition on many campuses nationwide. We found that this project has the potential to have a significant impact as we all grapple with the on-going changes in Title IX.

Poster 70

Presenter: Alexis Kunz (University of Utah)
Mentor: Kristina Rand (Psychology)
GPS Reliance and its Effect on Working Memory and Spatial Ability

As cell phone usage and technology is increasing in prevalence and its capabilities to the everyday user, the usage of tech-based navigational aids has also increased exponentially (specifically, the use of GPS maps on cellular devices). On the surface, this looks like a positive - electronic navigational assistance is faster than making a detailed plan from a physical map, requires less attention, and can be used on devices that are usually within reach of that individual most of each day. However, there are trade-offs in effectiveness of physical compared to electronic navigational aids. While a physical map takes more time to plan out directions, it does not require battery life and allows users to remember cardinal information of an environment. Electronic navigational aids are constrained by requiring some sort of battery and service reception in order to function, and may not require learning cardinal information. Previous studies have investigated how GPS usage over paper maps and direct experience for navigation is related to a decline in spatial recall, but no studies have looked at how a person's level of GPS reliance (e.g. needing to use GPS for navigational purposes to places they've become familiar to, such as a job or school) impacts both spatial ability and working memory capacities (as working memory is highly correlated with spatial ability). The study tested both large and small-scale spatial ability, working memory capacities, as well as GPS reliance levels through various computer programs and tasks. Post-experimentation, regression analyses seem to indicate that extensive GPS reliance is related to a decrease in large-scale and most forms of small-scale spatial ability, as well as poorer performance on a working memory task. Future studies would involve factoring in long-term versus short-term usage of GPS technologies, and looking more extensively at how a person's place of origin may be a mediating factor (e.g. Utah has a grid system but the East Coast does not, etc.).

Poster 71

Presenter: Billy Finlay (University of Utah)
Mentor: Brennan Payne (Psychology)
The role of left inferior frontal gyrus in memory for predictable and unpredictable words: An event-related transcranial magnetic stimulation study.

Humans comprehend language with remarkable speed. One way that the brain appears to accomplish this feat is by generating predictions about likely upcoming input. When input is predictable based on the prior context (e.g., "I take my coffee with cream and sugar"), word recognition is facilitated, whereas less-predictable words (e.g., with cream and honey) are processed with less ease. At the same time, there is little understanding of the fate of these words in long-term memory. Some studies suggest that predictable words are better remembered, whereas others suggest that prediction violations are encoded more saliently in memory. Although the use of context in predicting upcoming words has been thoroughly studied using EEG techniques, the underlying neural mechanisms involved in memory for (un)predictable words are less well understood. One area of the brain known for speech production and cognitive control, the left inferior frontal gyrus (LIFG), may be recruited to predict upcoming words. In this study, we applied a novel technique to examine the role of the LIFG in memory for predictable and unpredictable words: transcranial magnetic stimulation (TMS). TMS is a non-invasive neurostimulation technique that induces electric currents in the brain. In this study, participants read category cues (e.g., A type of tree) paired with target words that were either predictable (high typicality, e.g., oak), unpredictable (low typicality, e.g., ash), or incongruent (out of category, e.g., tin). Repetitive event-related TMS (5Hz) was used to induce cortical inhibition of the LIFG or its right-hemisphere homologue (RIFG, an active control site) during the category cue. Memory was assessed via a delayed cued-recall task. If LIFG is recruited in the prediction process, we expect cortical inhibition of LIFG during category processing to impact the subsequent recall of predictable and unpredictable words. Pilot results from our initial 10 participants will be presented and discussed. Findings have implications for our understanding of the neural mechanisms of language prediction

Poster 72

Presenter: Jacqueline Zickella (Brigham Young University)
Mentor: Norman Taylor (Anesthesiology)
Inflammatory Hyperalgesia in Rats: Strain Matters

Different rat strains have different biological backgrounds, which might impact mechanisms involved in pain mediation. Thus, strain differences should be taken into consideration in studies evaluating conditions associated to pain. In this preliminary study, we evaluate the sensitivity to painful stimulation in three strains of male rats, Sprague Dawley (SD), Brown Norway (BN), and SS Dahl (SS), previously shown to present specific phenotypes associated to differences in their genetic background. We found that, when compared to SD and BN, the SS rats showed a significantly lower mechanical nociceptive threshold. Next, we investigated whether these strains would also present differences to mechanical stimulation during inflammatory conditions, using two slightly distinct models of inflammatory hyperalgesia, i.e., an acute, short-lasting mechanical hyperalgesia produced by intraplantar injection of prostaglandin E2 (PGE2), and a model of post-operative hyperalgesia, plantar incision, which produces an acute but long-lasting local hyperalgesia. To evaluate the mechanical nociceptive threshold, we used the von Frey filaments paw withdrawal test. We observed that the plantar incision produced mechanical hyperalgesia with similar time-course and magnitude in all three strains. However, the hyperalgesia induced by PGE2 was significantly different in the SS rats when compared to the SD and BN, with delayed peak, smaller magnitude and shorter time-course. These findings suggest that a different mechanism is likely involved in the mediation of the immediate nociceptor sensitization produced by inflammation in SS rats. On the other hand, differences between the strains might not be enough to impact the longer acute sensitization produced by inflammation, such as the one observed during post-operatory period produced by the plantar incision. Therefore, the contribution of the strain background in the development and/or susceptibility to other types of pain such as neuropathic must be considered when designing a study.

Poster 73

Presenter: Davis Garner (Brigham Young University)
Mentor: David Belnap (School of Biological Sciences)
Investigating the Polymorphs of Polyomavirus Particles

The structure of the polyomavirus is primarily composed of the capsomere VP1. VP1 forms pentamers with a protruding tail from each monomer; pentamers bind together to form the viral capsid. Interestingly, VP1 pentamers will create polymorphic capsids that vary in shape and size when put in different environmental conditions. The conditions and structure of the pathogenic polyomavirus capsid have been thoroughly studied in previous research, which has revealed that the VP1 tails of adjacent pentamers interact to hold the capsid together. However, nonpathogenic capsid assemblies have received little attention and there is much knowledge to be gleaned from examining them. To do so, we are constructing high-resolution models of multiple VP1 capsids by expressing and purifying VP1, stimulating the formation of the capsids of interest, and then imaging the capsids via cryo-electron microscopy. All the images taken will be composited through software to create accurate and detailed models of the unique capsids. The models that we create will not only give great insight about the capsids of interest, but they will also elucidate interactions between VP1 tails that have never been understood before.

Poster 74

Presenter: Michael Zickella (Brigham Young University)
Mentor: Norman Taylor (Anesthesiology)
D-Amphetamine-Induced Analgesia Involves Communication Between The Periaqueductal Gray And Rostroventral Medulla

Neural dopamine (DA) modulators such as D-amphetamine provide a promising new approach to treating pain, though their analgesic mechanism has not been totally understood. Considering that these psychostimulants represent a possible alternative to the use of opioids, avoiding their associated side effects, our study aims to contribute to a better understanding of the mechanisms involved in the analgesia produced by D-amphetamine. We have previously shown that systemic injection of D-amphetamine produces analgesia and activation of DA neurons in the periaqueductal gray (PAG). Thus, we hypothesized that PAG DA neurons are antinociceptive and contribute significantly to the analgesic effect of D-amphetamine via descending spinal cord inhibition at the rostral ventral medulla (RVM). Separate groups of male C57BL/6 mice were stereotaxically prepared with infusion cannula targeted to either the PAG or RVM. We observed that the systemic D-Amphetamine-induced analgesia was inhibited by pretreatment into the RVM with the GABAA receptor agonist Muscimol, but not by antagonists for D1 receptor (SCH-23390), D2 receptor (Eticlopride), or glutamate receptors (Kyunerate), expressed in the RVM. Direct microinfusion of D-amphetamine, L-DOPA, or a selective D2 receptor agonist, but not a D1 agonist, into the PAG produced analgesia to thermal stimulation, suggesting that D-amphetamine acts in PAG neurons at D2 receptors. Finally, we found that activation of D2 receptors in the PAG by Quinpirole produced analgesia that was prevented by the injection, into the RVM, of Muscimol, suggesting that PAG D2 receptors-dependent analgesia involves GABAA receptors in the RVM. The accuracy of the target injections was

confirmed by histological analysis of the location of the cannulas directed to the PAG or RVM. These findings indicate a modulatory role of D2 receptors and descending inhibition through GABAergic receptors at the RVM in D-amphetamine-mediated analgesia. Moreover, they suggest that the use of stimulants could improve pain control, potentially as an alternative to opioids.

Poster 75

Presenter: John Lund (Brigham Young University)
Mentor: Jason Wiese (School of Computing)
Identifying Principles for Software to Support Daily Action Planning

A variety of software applications are designed with the intention to support people in their time management. Despite the availability of these tools, many people struggle to get things done in the time they have, suggesting a disconnect between them. Existing literature takes a tool-based focus, looking at digital calendars, to-do lists, email, or personal information management rather than a holistic investigation of time management. This work reports results from an interview and diary activity data from 19 graduate students investigating the tools (digital and paper) and strategies used to manage their time. It also explores how these students engage in a short-term planning task and respond to making concrete plans for the next day for multiple days. Participants relied on unique combinations of tools, habits, and their own memory to manage their time. However, there were structural similarities in their approaches, indicating opportunities for technology to better support time management. Based on principles informed by these similarities, we are developing a mobile application designed to support users in developing daily plans. The application departs from conventional to-do list applications by creating a text-editor-based experience to introduce greater flexibility while still maintaining powerful capabilities such as calendar integration, date formatting, and easy sharing.

Poster 76

Presenter: Emile Eich (Northern Arizona University)
Mentor: Sihem Boudina (Human Genetics)
Differences in Stem-like Progenitor Cell Populations in Visceral Fat

Accumulation of visceral fat (VIS) is correlated with a higher risk of cardio-metabolic abnormalities such as insulin resistance and type 2 diabetes. VIS fat expands via adipocyte hypertrophy or through de novo recruitment and differentiation of adipose progenitors (APs). My experiment involved the validation of cell surface markers identified in previous single cell sequencing to improve purification of VIS APs. After isolating VIS fat samples from male C57B6 mice, stromal cells from tissue samples underwent a fluorescence-activated cell sorting strategy (FACS) to sort VIS APs displaying either a high or a low expression of CD34 respectively. Cells were cultured in growth media, underwent single cell sequencing, and preliminary results revealed that there is a significant difference between CD34 high (VH) and CD34 low (VL) APs populations. To better isolate the VH and VL subsets of APs, CD200 was identified due to its ability to define anti-adipogenic (VH) APs. Subsets of CD200 positive and negative VH and VL APs were differentiated into adipocytes using adipogenic media (insulin, dexamethasone and IBMX) for 6 days and lipids were stained with BODIPY 650 and DAPI. Images were captured using an inverted IX-71 Olympus epi-fluorescence microscope and BODIPY quantification analysis determined that there is no significant difference in adipogenesis between CD34 low, CD200 low cells and subcutaneous cells ($p=0.16$). However, both cells types are significantly more adipogenic than CD34 mid, CD200 low cells ($p < 0.05$). We concluded that CD200 is a superior marker for sorting high adipogenic cells from visceral adipose stromal cells.

Poster 77

Presenter: Trent Stafford (College of William and Mary)
Mentor: Swomitra Mohanty (Bioengineering)
Electrocatalytic, Black Titania Lysing of Cells for Biofilm Elimination, Water Purification and Biofuel Refining

My lab has created an electrocatalytic, black titania probe which, when current is run through it, fires hydroxyl radicals at cells it is directed towards, mechanically shredding them. This technology can be used to destroy biofilms, or antibiotic-resistant, surgical infections that afflict over 100,000 people each year. The current required to eliminate biofilms is not great enough to harm patients treated by it. This technology can also be used to eliminate pathogens in water. Since the probes are very inexpensive, require little voltage to operate, and are easily shipped/assembled, they can help provide clean water to the 800 million people worldwide in resource-limited areas who lack it. Lastly, this technology can destroy the cell walls of algae at a lower energy-cost than contemporary methods. Since many algae develop large amounts of lipids which can be refined into fuel for engines, our methods mark a substantial step toward making algal biofuels a viable energy source.

Poster 78

Presenter: Brighton Alvey (University of Utah), **Andrew Smith** (University of Utah)
Mentor: Andrew Roberts (Chemistry)
Chemoselective Macrocyclization of Tyrosine Containing Peptides

Peptidic therapeutics define a growing field of medicinal chemistry, evidenced by more than 100 new drug candidates entering clinical trials in 2010 alone, global sales surpassed US $1 Billion that same year. Often inspired by natural products, the success of these medicines can be attributed to their selective binding toward protein targets. The ease of metabolic degradation into relatively non-toxic amino acid residues render most peptides with overall low toxicity and with limited risk of adverse interactions. However, their medical potential is often overshadowed by the inability peptide-based drugs to reach their target in vivo. Delivery to the target site is further challenged by poor substrate solubility across the mucosa and rapid degradation by proteolytic enzymes. The modification and/or cyclization of bioactive linear peptides continues to be a promising strategy to address these issues. Such modifications can improve pharmacokinetic properties while maintaining or in some cases enhancing their activities. Current modification and macrocyclization techniques rely on the functionality of specific amino acid residues and can be limited in scope. Recent developments with the electrophilic, N4-substituted-1,2,4-triazoline-3,5-dione(s) (TADs) moiety provide for efficient macrocyclization of peptides utilizing any terminal amine group (providing a site for TAD installation) and tyrosine (Tyr) via a 'click like' ene-reaction. We are developing the scope and limitations of this chemoselective macrocyclization reaction. Our method may allow for unique structural diversity of peptides and permit expedited access to macrocyclic types previously difficult to obtain.

Poster 79

Presenter: Avery Abelhouzen (University of Utah)
Mentor: H Joseph Yost (Neurobiology & Anatomy)
Analyzing Zebrafish Models of Hypertrophic Cardiomyopathy using a Cardiac Stress Test

Hypertrophic cardiomyopathy (HCM) is a heart disease in which the walls of the ventricle will thicken due to the enlargement of cardiomyocytes. Cardiomyopathy is a huge concern as it is the number one cause of cardiac failure in young adults and affects around 1 in 500 people. The Yost lab has developed the first model of HCM in zebrafish, as well as discovered that mutants of the Notch ligand, Jag2b, display a similar HCM phenotype. However, the cause of HCM in the jag2b mutants remains unknown and the phenotype is not fully characterized. Using novel physiological read-outs, my summer project will further characterize the phenotype of the jag2b mutant zebrafish. Initially, the jag2b genotyping protocol required optimization, so that cohorts of each genotype, homozygous wildtype, heterozygous mutant, and homozygous mutant could be generated. Equivalent numbers of each genotype, distributed evenly between age-matched males and females, will be subjected to a cardiac stress assay by means of a swim tunnel. Similar to a treadmill test for human cardiac patients, the swim tunnel forces fish to swim against a current that increases in a stepwise manner. In addition to velocity, the swim tunnel measures the rate of oxygen consumption and temperature. The swim tunnel has now been built, tested and optimized for our zebrafish. Currently, preliminary analyses to discover the optimal temperature and oxygen are underway. The data acquired from swim tunnel assays will help determine the requirements for Jag2b in cardiac function.

Poster 80

Presenter: Benjamin Ringham (University of Wisconsin La-Crosse)
Mentor: Lisa Joss-Moore (Pediatrics)
Postnatal Growth Restriction Causes Sex-Divergent Changes in Rat Lung Elastin and Mechanics

Postnatal growth restriction (PGR) increases bronchopulmonary dysplasia (BPD) in preterm infants, with outcomes worse in males. BPD is characterized by impaired lung elastic fiber deposition and lung mechanics. A critical component governing elastic fiber deposition and lung mechanics is the fatty acid docosahexaenoic acid (DHA), which is also deficient in BPD. We previously showed, in a rat model, PGR decreases DHA in male, but not female, rats. PGR was induced using variation in litter size, with newborn rat pups randomized to PGR (16 pups/litter) with regular diet or a diet supplemented with DHA (0.01% or 0.1%), or Control (8 pups/litter) with regular diet. At day 21, we measured lung elastic fiber deposition using Hart stain, and lung mechanics using a Flexivent. PGR and diet effects were assessed using ANOVA. Results are %control±SD (*=$p<0.05$). PGR rat pups on all diets weighed less than control from day 5 onwards. Regular diet PGR increased elastic fiber density in male rats (143±41%*), but not in female rats (115±52%). The effects of DHA on PGR elastic fiber deposition, and the effects of PGR and DHA on lung mechanics are still being evaluated. In the rat lung, PGR causes sex-divergent changes in elastic fiber deposition. We speculate that reduced DHA availability drives increased elastic fiber density in male rats, and that supplemental DHA may be a valuable therapeutic means of restoring DHA in BPD.

PRESENTER INDEX