Office of
UNDERGRADUATE RESEARCH
THE UNIVERSITY OF UTAH

2021 Summer Symposium

THURSDAY, AUGUST 5, 2021
9:00AM - 12:00PM
Virtual Event
UNIVERSITY OF UTAH

2021 SUMMER SYMPOSIUM

Thursday, August 5, 2021
9:00 AM – 12:00 PM
Virtual Event
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 Beckman Scholars Program, the Chemistry Research Experience for Undergraduates (REU), the Genomics Summer Research for Minorities (GSRM) Internship, the Growing RUUTES: Summer Undergraduate Research Experience, the Huntsman Cancer Institute's PathMaker Cancer Research Program, the Native American Summer Research Internship (NARI), the Pathology Summer Program, the Physics & Astronomy REU and Summer Undergraduate Research Program, the Research Experience in Alpine Meteorology (REALM) REU, the Research Experience in Utah for Sustainable Materials Engineering (ReUSE) REU, and the Summer Program for Undergraduate Research (SPUR), and the Summer Undergraduate Research Internship in Pharmaceutics and Drug Delivery. Together, these programs are serving more than 180 undergraduate researchers in Summer 2021.

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

9:00 – 10:30 AM	**POSTER SESSION I**
10:30 AM – 12:00 PM	**POSTER SESSION II**

SCHEDULE OF PRESENTATIONS

POSTER SESSION I

9:00 – 10:30 AM

Poster 1

Presenter: Aviva Levin (Arizona State University)
Mentor: Michael Scarpulla (Electrical and Computer Engineering)
Gallium Oxide

Gallium oxide (Ga_2O_3) is of interest as a semiconductor material because of its ultrawide bandgap of 4.8eV, crystal structure, and n-type doping conductivity. Such a wide bandgap in a semiconductor can withstand high voltages and electric fields. Alloying β-Ga_2O_3 with Al_2O_3 (bandgap 6.36eV) increases the material's resistance to high voltages and electric fields, even more, a motivation for characterizing the diffusion of aluminum in Ga_2O_3. Studying the concentration of gallium vacancies (V_{Ga}), a native defect in β-Ga_2O_3, is instrumental in characterizing the diffusion of aluminum in β-Ga_2O_3, because aluminum is a substitutional alloying element in β-Ga_2O_3. The diffusion of [V_{Ga}] can be described independently by an analytical solution using a uniform and constant coefficient of diffusion, D_{VGa}. To describe a solution for the diffusion of [Al], we started with Fick's 2nd Law of diffusion with a non-constant coefficient of diffusion, D_{Al}, and assumed D_{Al} is proportional to the local [V_{Ga}](x). Finally, we derived a novel finite-differences scheme based on Crank-Nicholson implicit method (1st order in time, 2nd order in x). We implemented the boundary conditions for [Al], diffusion equations scenarios for [V_{Ga}], and a discretization equation for iterating the diffusion process in a MATLAB code. Experimentally, we grew 9-period superlattices of 200 nm Ga_2O_3 / 15 nm $(Al_xGa_{1-x})_2O_3$ with x = 0.05nm on (010)-oriented Sn-doped Ga_2O_3 wafers using OMVPE. Next, we measured initial SIMS profiles of the [Al] vs depth before annealing samples 1 and 2 in O_2 at 1100˚C for 2 and 20 hours, respectively. Afterwards, we measured the final SIMS profiles of the [Al] vs depth and compared with the initial profiles. We ran iterations with different [V_{Ga}] diffusion scenarios and scaling coefficients for D_{VGa} and [V_{Ga}] until we reached a well-matched [Al] vs depth profile to the SIMS results.

Poster 2

Presenter: Zach Eatough (University of Utah)
Mentor: Amy Lenz (Orthopaedics)
QUANTITATIVE MODELING TO EVALUATE ANKLE OSTEOARTHRITIS MORPHOLOGY

Clinical evaluation of end-stage ankle osteoarthritis, which is commonly denoted by joint degeneration and osteophyte growth, is primarily derived from 2D conventional x-rays. Emerging weight-bearing computed tomography (WBCT) allows researchers and clinicians to better visualize and characterize ankle morphology. Segmentation of WBCT scans from patients with end-stage osteoarthritis generate patient specific 3D bone reconstructions that can be used in a variety of analyses. 3D bone morphology can quantify malalignment, subluxation, and joint space narrowing which are all related to osteoarthritis. Statistical shape modeling allows for population based morphological comparisons. Upon consideration of group wide statistics, these data can guide diagnosis and treatment of pathological ankles ideal leading to improved patient outcomes and quality of care.

Poster 3

Presenter: KC Herne (Norwich University)
Mentor: Joshua Bonkowsky (Pediatrics)
Prevalence of Genetic Disease in the Neonatal Intensive Care Unit

The diagnosis of genetic disease often occurs at a later stage in life and can significantly impact the lifestyle of the patient. In recent years, genetic testing has become much more affordable, accessible, and the results of an entire genome sequence can be found in 24-48 hours. This study, which looks at genetic testing for children admitted to NICU, seeks to establish the rate of abnormal genetic test results in NICU patients, the age at which these results were received, and if the care of these children was altered by the abnormal results. This was achieved via two data research methods. The first was using ICD codes to determine children who have stayed in the NICU for a set amount of time with an ICD code relating to a genetic condition. This list was crossed-referenced with those patients who came back for a follow-up appointment 10 years later. This final list was examined to identify any similar characteristics or patterns. This study will determine a set of criteria that will allow for early determination if a genetic test can be beneficial. In summary, this study may challenge the current standard of care in the NICU and suggest that maybe universal genetic testing should be performed on all infants admitted to level IV NICUs.

Poster 4

Presenter: Shaelee Nielsen (Southern Utah University)
Mentor: Brock O'Neil (Surgery)
Rural disparities in cardiovascular and cerebrovascular health among Utah prostate cancer survivors

Prostate cancer survivors may experience late effects associated with cancer and cancer treatment, including cardiovascular disease. Rural prostate cancer survivors may have higher rates of cardiovascular disease than their urban counterparts due to risk factors higher among rural populations such as limited access to healthcare resources and increased use of androgen-deprivation therapy, a prostate cancer treatment associated with cardiovascular disease. The purpose of this study is to assess the risk of cardiovascular disease among rural prostate cancer survivors in Utah in comparison to their urban counterparts. Using the Utah SEER Cancer Registry and the Utah Population Database (UPDB) we identified 3,903 rural prostate cancer survivors and their 19,259 urban counterparts who met our eligibility criteria. We estimated the risk of each cardiovascular and cerebrovascular disease for urban and rural prostate cancer survivors and conducted rural/urban hazard ratios and 95% confidence intervals using the Cox Proportional Hazards Model. Rural prostate cancer survivors were more likely to be non-Hispanic, white, have a family history of prostate cancer and cardiovascular disease, and have more comorbidities than their urban counterparts. Urban men were more likely to receive radiation and/or surgery as a first course treatment, while rural men were more likely to receive hormone therapy or no first course treatment. Compared to their urban counterparts, rural prostate cancer survivors experienced higher rates of several cardiovascular diseases one to five years after initial cancer diagnosis. Five plus years after initial cancer diagnosis, rural prostate cancer survivors experienced even higher rates of many cardiovascular and cerebrovascular diseases. Causes of higher rates of cardiovascular disease among rural prostate cancer survivors are uncertain but may be associated with rural-urban differences we found in prostate cancer treatment. Further research must be conducted to identify methods to reduce rural disparities in prostate cancer care and outcomes.

Poster 5

Presenter: AJ Holder (Haskell Indian Nations University)
Mentor: Deirdre Caplin (Psychology)
Evaluating the Impact of Mental Health on Pain Related- Cognitions in Pediatric Headache Patients

Prior literature shows us that cognition, mental health, and functioning independently impact pediatric pain experience. In this study we are predicting that pain catastrophizing mediates the relationship between mental health and functional disability. Using an existing clinical database, information from 581 parent and child dyads was analyzed. Parents and children each completed self report scales of pain catastrophizing, child internalizing symptoms, and functional disability as part of routine clinic protocol. Data was analyzed using regression models for both parent and child reported scales to test the mediation hypothesis. Preliminary results indicate that the indirect effect of child reported internalizing symptoms on functional disability through child reported pain catastrophizing was statistically significant [effect= 0.62, 95% C.I. (0.2255,1.0889)]. The indirect effect for parent reported measures was not statistically significant. In conclusion,

patient cognitions play an important role in explaining the association of mental health and functional disability. Our results support the use of Cognitive Behavioral Therapy interventions for children with functional disability from headache.

Poster 6

Presenter: Jordyn Gagon (University of Utah)
Mentor: Moriel Zelikowsky (Neurobiology & Anatomy)
Inhibition of Prefrontal Cortex Pyramidal Neurons Alters Social Behavior in Mice

Damage to the prefrontal cortex has shown to increase aggression (Siever, 2008) and the medial prefrontal cortex plays an inhibitory role in initiating and executing aggressive behavior (Takahasi, 2014; van Heukelum, 2021). Designer Receptors Exclusively Activated by Designer Drugs (DREADDS) with the ligand drug Clozapine-N-Oxide (CNO) works to control neuron firing by controlling GPCR pathways (Roth, 2016). This project seeks to find if inhibition of the mPFC via DREADDS virus' activated by CNO induces aggression or alters social behavior. Results show that DREADD mediated inhibition of the mPFC lead to altered social behaviors, but did not induce aggression. Male mice had a significant increase in front and back investigations. Female mice follow a similar trend but did not have a significant difference in back, front, or rear investigations. Future steps would include isolating mice to onset aggression, then inject an inhibitory DREADD into the medial prefrontal cortex pyramidal neurons.

Poster 7

Presenter: Wisen Ji (University of california, Berkeley)
Mentor: Michael Free (Materials Science and Engineering)
Separation of Rare Earth Elements from Coal-Based Resources

Rare earth elements or REEs are used extensively in modern technology and their availability is important to the many industries that use them. Without REEs, we could not have the screens of smartphones, the batteries of electric cars, semiconductors, magnets, and even fluorescent lighting. Unfortunately, it is difficult to find REEs in high enough concentrations for economical extraction that is also safe for the environment. Additionally, different REEs are often found grouped together, and it is challenging to separate them. Research conducted preceding this study found coal waste as an alternative resource for REE production by extracting the REEs through bioleaching and precipitation processes. The acid used for leaching was formed from the oxidation of pyrite with Acidithiobacillus ferrooxidans. The acidified bioleaching solution was used to extract REEs from coal waste. This current study focuses on the separation of these extracted REEs. To separate the REEs from each other, electrowinning tests were performed. Electrowinning is the process of recovering dissolved metal in a solution by applying a negative potential to an electrode, on which the metal deposits. After deposition, the energy consumption and current efficiency of the samples were determined to measure the overall deposition efficiency. Scanning Electron Microscopy (SEM) mapping was also conducted to reveal information about the sample, including texture and chemical composition. By conducting a selective potential approach, in which we deposit different REEs at different voltages, we can effectively separate REEs that have been leached from coal waste. This creates a reliable and sustainable supply of REES for the many industries that use them.

Poster 8

Presenter: Elena Yee (University of Utah)
Mentor: Micah Drummond (Human Genetics)
Effects of Macrophage Immunotherapy Treatment to Improve Muscle Recovery Following Disuse Atrophy in Aged Mice

It has been widely known that extended periods of muscle disuse and/or injury can lead to muscle atrophy within the skeletal muscles. This is concerning especially for the elderly population, since they are more prone to increased risk from falling, developing illness, and worsening disease complications. Aging muscle has a compromised immune system, and this results in a dysfunctional response from macrophages to regrow muscle tissue. Macrophages, a category of white

blood cells found within our immune system, are known for regulating/defending against infection/injury via processes of inflammation and phagocytosis by releasing growth factors that play a critical role in muscle regeneration and organization. The purpose of this study was to examine the effects of injecting aged mice with pro-inflammatory macrophages from young adult mice into the hindlimb muscle to detect if it stimulates an immune response that improves muscle recovery, after following a period of disuse atrophy. The experiment involved young adult and aged mice that underwent muscle atrophy and recovery (2-weeks of hindlimb unloading followed by a 4-day recovery period). Bone marrow-derived macrophages (BMDMs) were isolated from young adult and aged mice. These cells were cultured in a dish, changed to pro-inflammatory macrophages, and then injected into the right hindlimb of young adult and aged mice after 1-day of ambulatory recovery from hindlimb unloading. On day 4 of recovery, the mice were humanly euthanized for analysis of the soleus muscle. We found that the delivery of young adult pro-inflammatory macrophages into aged mouse muscle helped improve muscle recovery, as measured by ex-vivo muscle force production, while the delivery of aged pro-inflammatory macrophages did not alter the recovery in both young adult and aged mice. This investigation of immunotherapies could potentially lead to new treatments that help skeletal muscle recovery following disuse atrophy especially regarding the elderly.

Poster 9

Presenter: Aparna Mangadu (The University of Texas at El Paso)
Mentor: Sara Grineski (Sociology)
Using Big Data to Estimate Prenatal Environmental Exposures

Research has revealed that prenatal exposure to environmental hazards is associated with loss in IQ. Prenatal exposures may also be linked to developmental disorders such as intellectual disability and autism. Measuring prenatal exposures directly is costly, time intensive and somewhat invasive, making it hard to scale up to a population-level. Through the use of publicly available data, researchers can assess prenatal exposures to environmental hazards at a low cost. The goal of this project was to use the available data to estimate prenatal exposures for Utah children (based on birth certificate data) to criteria air pollutants, industrial pollutants, and residential lead exposures. We used data from the Center for Air, Climate, and Energy Solutions (CASES) to estimate annual criteria air pollution exposure at the census block group level. We used the US EPA's Risk-Screening Environmental Indicators (RSEI) to estimate annual non-cancer health risks in 810x810 meter grids due to industrial emissions. We used the American Community Survey (ACS) median age of housing stock block group variable to estimate exposure to lead paint and pipes (≤1978, 1978-1985). Children were assigned pollution estimates pertaining to their birth year, based on their home address. Strengths of using secondary data to estimate prenatal exposures include that it is often low cost and available annually, which matches the birth year, and the geographic resolution is sufficient. Limitations include that we only examine residential exposures, neglecting occupational risks; we base lead exposure on birth year and home address, without knowledge of the time-space geography of the parent; and we use annual averages that are not specific to critical windows of pregnancy. The next step in the project is to use these data to examine associations between prenatal hazardous exposures and intellectual disability in children. Examining this association may highlight a health consequence of increased exposure and provide results that emphasize the need for better protections in vulnerable communities.

Poster 10

Presenter: Adam Gaudin (Dixie State University)
Mentor: Ariadne Penalva (Neurobiology & Anatomy)
Investigating Social Behavior and Memory in Danionella Translucida

Danionella Translucida are an alternative model organism that is being verified. One of the ways that Danionella are being compared to their baseline cousins the Zebrafish are through behavior testing and social reward conditioning. This was done using a classical conditioning test to see if the tested fish associated a pattern with social reward.

This experiment shows that the association lasts much longer than the initial testing phase. The experiment showed significance up until T+90 minutes and is trending towards significance up to 24 hours after the initial testing phase. This is comparable to both mature and immature behavior in Zebrafish, with the significance past T+0 being a novel finding.

Poster 11

Presenter: Christian White (Southern Utah University)
Mentor: Stavros Drakos (Internal Medicine)
CD38 as a Potential Therapeutic Target in End-Stage Heart Failure

End-stage heart failure (HF) is a condition in which the heart loses its ability to pump blood effectively to the rest of the body. After a myocardial infarction, initial replacement fibrosis takes place where fibroblasts are activated to form myofibroblasts. The myofibroblasts produce extracellular matrix component, collagen to replace the dead cardiomyocytes. This process is beneficial to prevent cardiac rupture. However, excessive collagen deposition leads to cardiac muscle stiffness and thereby leads to HF.

RNA sequencing on human myocardial tissue revealed a significant downregulation of CD38 mRNA in the responder population with high fibrosis compared to donors. In contrast, examining the infarct region in HF patients resulted in increased CD38 expression suggesting an important role of CD38 in active fibrosis and a plausible role in fibrosis reversal. CD38 is a transmembrane receptor known to hydrolyze NAD+ which in turn leads to fibroblast activation. Previous studies on other models of fibrosis suggests CD38 inhibition as a potential mechanism to prevent fibrosis progression. Our preliminary results show that CD38 inhibitor, 78c reduced cardiac myofibroblast formation evident from reduced Transgelin 2 (SM22) and alpha-smooth muscle actin (α-SMA) expression suggesting a potential role of CD38 in cardiac fibrosis. Future steps include in-vivo drug assessment in myocardial infarction mice model and understanding the process of fibrosis reversal.

Poster 12

Presenter: Alexa Rosenthal (Northern Arizona University)
Mentor: Michael Free (Mining Engineering)
Separation of Rare Earth Elements from Coal-Based Resources

Rare earth elements or REEs are used extensively in modern technology and their availability is important to the many industries that use them. Without REEs, we could not have the screens of smartphones, the batteries of electric cars, semiconductors, magnets, and even fluorescent lighting. Unfortunately, it is difficult to find REEs in high enough concentrations for economical extraction that is also safe for the environment. Additionally, different REEs are often found grouped together, and it is challenging to separate them. Research conducted preceding this study found coal waste as an alternative resource for REE production by extracting the REEs through bioleaching and precipitation processes. The acid used for leaching was formed from the oxidation of pyrite with *Acidithiobacillus ferrooxidans*. The acidified bioleaching solution was used to extract REEs from coal waste. This current study focuses on the separation of these extracted REEs. To separate the REEs from each other, electrowinning tests were performed. Electrowinning is the process of recovering dissolved metal in a solution by applying a negative potential to an electrode, on which the metal deposits. After deposition, the energy consumption and current efficiency of the samples were determined to measure the overall deposition efficiency. Scanning Electron Microscopy (SEM) mapping was also conducted to reveal information about the sample, including texture and chemical composition. By conducting a selective potential approach, in which we deposit different REEs at different voltages, we can effectively separate REEs that have been leached from coal waste. This creates a reliable and sustainable supply of REES for the many industries that use them.

Poster 13

Presenter: Natalia Etsitty (Loyola University Chicago)
Mentor: Keir Balla (Human Genetics)

Virus Infection and Inflammation in Zebrafish

The nature of viruses has been problematic for humanity due to its vast diversity and capabilities. Due to the challenging nature of studying viruses in internal tissues, zebrafish are used to study infection and immune systems in living animals. To further study viruses, we used a transparent model organism, zebrafish, to visualize the immune system and its responses to infection. We previously discovered a picornavirus in the gut that infects the zebrafish's intestine. We hypothesize that fish activate inflammation in the intestines to get rid of infection. To test our hypothesis, we used genetically modified zebrafish that label neutrophils and antiviral immune signals. Using confocal microscopy, we imaged infected and uninfected animals and observed higher levels of neutrophils in the intestines of infected animals. These observations were consistent with our hypothesis that higher levels of inflammation are in infected animals. We speculate that these higher levels of inflammation are important to eliminate infection. Further work investigating inflammation and infection in this system will allow us to study the balance between inflammation defense and disease to develop new treatments. Our future research will be aimed at confirming the role of inflammation in the intestines and seek if it is present in other tissues of the zebrafish.

Poster 14

Presenter: Alexis Lyons (East Central University)
Mentor: Katsuhiko Funai (Physical Therapy and Athletic Training)
Deletion of ATG3 Protects Mice from Disuse-Induced Skeletal Muscle Atrophy

Disuse of skeletal muscle causes loss of muscle mass and strength. Autophagy is a process by which cell components are degraded, although it is unknown whether inhibition of autophagy can prevent disuse-induced skeletal muscle atrophy. Autophagosome formation is partly mediated by ATG3, a component of autophagy maturation that is essential for autophagy-dependent protein degradation. In this study, we investigated whether deletion of muscle ATG3 would be sufficient to prevent the loss of muscle mass and strength induced from hindlimb unloading (HU) in mice. Mice with tamoxifen-inducible skeletal muscle-specific knockout of ATG3 (ATG3-MKO) were studied with a 14-day HU to induce disuse. At the end of 14 days of HU soleus extraction was performed where muscle mass and force-generating capacity were quantified ex vivo. Strikingly, ATG3-MKO mice were partly protected from the loss of muscle mass and strength induced by HU. Analyses of skeletal muscle fiber-type and cross-sectional area were also performed. In conclusion, ATG3 is essential for the full effect of disuse to promote the loss of muscle mass and strength. Targeted inhibition of autophagic machinery may be a useful strategy in ameliorating muscle atrophy.

Poster 15

Presenter: Abigail Monahan (Skidmore College)
Mentor: Aaron Puri (Chemistry)
Matching Synthases and Signals: Extracting and Analyzing Quorum Sensing Signals from Underexplored Proteobacteria

Bacterial species produce and receive unique natural products called quorum sensing signals which enable them to determine cell density and coordinate their group behavior. The Puri Lab in collaboration with the Joint Gene Institute (JGI) began an investigation into two bacterial communities involved in carbon cycling to understand how quorum sensing signals impact the composition and function of the species. First, we will catalog the acyl-homoserine lactone (acyl-HSL) signal inventory from the two bacterial communities and add it to a community database of known acyl-HSL synthase sequences linked to acyl-HSL signals. This will allow future researchers to predict which quorum sensing signals are being made using sequencing data. The JGI synthesized 180 quorum sensing signal synthases identified from the genomes and metagenomes of the carbon cycling bacterial communities and sent them to the Puri Lab. The inducible promoter responsible for the expression of these synthases was activated using isopropylthio-beta-galactoside (IPTG), producing the quorum sensing signal. We then extracted the signal from the supernatant. The signal will be analyzed by liquid chromatography-tandem mass spectrometry (LC-MS/MS) by the JGI to link the synthases with the signals they produce. We extracted supernatant from 366 cultures consisting of two independent replicates. We verified that quorum

sensing signals were produced by the synthases by using LC-MS to verify the structure of the group of known acyl-HSL signals and SDS-PAGE to check that synthase expression was activated by IPTG. We measured quorum sensing signal bioactivity using a reporter strain containing a receptor-responsive promotor controlling the expression of green fluorescent protein. Once we receive the LC-MS/s data from the JGI, the Puri Lab will troubleshoot the samples where acyl-HSL was not detected. We will also begin determining the acyl-HSL signal's impact on the composition and function of specific bacterial communities and add quorum sensing signals linked to specific synthases to a community database.

Poster 16

Presenter: Yein Ji (University of Utah)
Mentor: Emelie Mahdavian (Film & Media Arts)
Representation of Depression in Film

Depression is one of the most common mental illnesses in the world, yet still highly stigmatized. 12 films about people with depression were analyzed for patterns and recurring themes in the protagonist as well as the filmmaking style. The films analyzed were *Cake, Garden State, Little Miss Sunshine, Melancholia, The Hours, A Single Man, Leaving Las Vegas, It's a Wonderful Life, Manchester by the Sea, Ordinary People, Taste of Cherry, & Three Colors: Blue.*

The purpose of this research was to find if the characters showcased symptoms of depression as outlined in the DSM-5. How does the film creatively tell the story about someone with depression? 9 out of 12 films were about characters whose depression was related to a particular traumatic event in their life. In every film, the protagonist showed at least 5 symptoms of depression ex. Irritability, Depressed Mood, Loss of Interest, Fatigue, Feeling Worthless, Decreased Concentration, and/or Thoughts of Death/Suicide. None of the films showcased depression through negative stereotypes such as affiliating characters with the mental illness as violent, perverted, frightening, or dangerous.

Creative filmmaking elements such as bright, colorful color schemes were used to create a contrast between the world and the character's intrinsic mental state. In *Taste of Cherry,* warm golden light shines on Mr. Badii as he looks for someone to bury him once he takes his own life. Subtle filmmaking techniques such as slow zoom-ins, and steady pans, help bring the audience into the characters' minds. In *Ordinary People,* the camera slowly zooms in to Conrad's face as he explains how it felt to cut his wrists. Filmmakers can creatively showcase depression while still representing accurate symptoms. They can create a compelling film that is both entertaining and comforting to those with similar experiences.

Poster 17

Presenter: Jesse Hepner (Albion College)
Mentor: Caroline Saouma (Chemistry)
Developing Mn-Based Electrocatalysts for Hydrogenation

Fast pyrolysis of plants has been proposed as now conserving 90% of the plants' energy. This process generates bio-oil, which contains a mixture of organic carbonyl complexes. These species are prone to polymerization. Hence, the mixture must be hydrogenated prior to transporting to a refinery. Traditional hydrogenations are expensive and therefore inefficient, which explains the need for alternatives. Using electrocatalytic hydrogenation methods to promote a two electron and two proton transfer may prove to be a more efficient way of completing the task. The electricity used in these types of reactions can be solar-derived to be as efficient as possible. My poster describes our efforts at developing a Mn-based electrocatalyst for this experiment. A redox-active ligand was prepared and Mn complexes that may be pertinent to electrocatalytic hydrogenation have been made and characterized. Future work will test complexes for both catalytic and electrocatalytic hydrogenations of model substrates such as acetophenone. Together, this work will aid in the development of the new field of electrocatalytic hydrogenations.

Poster 18

Presenter: Trish Luu (University of Utah)

Mentor: Wenxiang Sun (Pathology)
ABCB10 Loss Selectively Impairs CD4 T Cell Cytokine Production

The immune system is crucial in fighting off diseases that manifest and pathogens that invade the human body. Within this complex system, T cells are responsible for recognizing foreign cells and terminating them. When T cells activate, a shift in metabolism occurs. Nutrients are transported into the cell to supply the increase of energy used for this metabolic shift. One of these transporters being an ATP-binding cassette protein known as ABCB10. In addition to transporting nutrients between mitochondrial membranes, ABCB10 is also necessary in erythropoiesis. To explore the function of ABCB10 in T cells, an ABCB10 conditional (floxed) mouse was crossed with a CD4-Cre mouse to yield offspring mice who don't express ABCB10 in T cells. PCR and gel electrophoresis were performed to confirm the genotype of these mice. Then, pan T cells were restimulated with anti-CD3/CD28 antibodies and the expression of IFNγ, TNFα and IL-2 were determined by flow cytometry. Results show that the lack of ABCB10 impairs TNFα and IL-2 production in CD4 T cells, but not CD8 T cells. Future studies will explore how the absence of ABCB10 affect CD4 T cell memory formation.

Poster 19

Presenter: Isaac Cao (University of Utah)
Mentor: Rajeshwary Ghosh (Nutrition and Integrative Physiology)
The Role of p62 in the Regulation of HIF1-Alpha in the Heart

Ischemic heart disease (IHD) is a major cause of death worldwide. IHD is characterized by cardiac tissue hypoxia (low oxygen levels), dysregulated metabolism, and cell death. A major component of the hypoxia pathway is the hypoxia-inducible factor 1a (HIF1α) whose stabilization is required to regulate several metabolic and angiogenic genes during hypoxia. In this study, we hypothesize that a protein called Sequestosome 1 (p62) is necessary for the regulation of HIF1α in the heart. p62 is a multifunctional protein with established functions in the regulation of several cellular pathways including autophagy function and redox homeostasis. However, its role in the heart during hypoxia is not known. To test our hypothesis, H9c2 cardiac myoblasts were cultured and exposed to physiological hypoxia (1% O_2) or normoxia (21% O_2) for 24h or chemically-induced hypoxia (treatment with 100 or 200 μM $CoCl_2$) for 24h. p62 knockdown in the H9c2 cardiac myoblasts was downregulated and did not alter HIF1α protein levels or its target gene (*Hmox, Egln1, Vegfa, Bnip3*) expression in either physiologically or chemically-induced hypoxia. Additionally, mice with tamoxifen-inducible cardiomyocyte specific p62 deletion (cip62KO mice) were generated and exposed to 7% O_2 for 6h to verify the effect of p62 deletion *in vivo*. Cip62KO mice did not show any changes in HIF1α target genes and were comparable to the control animals. Our study reveals that p62 may negatively regulate HIF1α and transcriptional activation. Further experiments are required to validate the role of p62 in the stabilization of HIF1α and hypoxia tolerance in the heart.

Poster 20

Presenter: Wyatt Fullmer (Southern Utah University)
Mentor: Jacob George (Electrical and Computer Engineering)
Bionic Sock: Conductive Thread as an Effective Electrode for Measuring Surface Electromyographic Signals

Surface Electromyography (sEMG) is a non-invasive technique for measuring electrical signals from muscle in real-time using electrodes placed on the surface of the skin. sEMG is used in a research setting to control assistive bionic devices as well as to track fitness metrics such as muscle fatigue. Current sEMG electrodes lack the durability and comfort necessary for sEMG to become practical in daily life. In specific, sEMG electrodes are not reusable and are difficult to don and doff. Here, we present a new sEMG electrode that is reusable, durable, and comfortable by using conductive thread to directly stitch electrodes into fabric. To demonstrate feasibility, we developed a sock with sEMG electrodes embedded via conductive thread to measure lower-limb muscle activity. The signal-to-noise ratio (SNR) of adhesive electrodes (clinical standard), dry metal electrodes (research standard), and the conductive-thread electrodes were measured using 20 trials of maximum voluntary contraction with the electrodes placed on a single participant's soleus muscle. The SNR of the conductive-thread electrodes (44.42 ± 4.64) was comparable to that of the adhesive electrodes (11.65 ± 0.46) and dry

electrode (65.03 ± 7.35). sEMG data from the conductive-thread electrodes was also used to predict ankle flexion/extension and inversion/eversion in real-time using a modified Kalman Filter. These results demonstrate that conductive-thread electrodes are a viable option for sEMG, and that their reusability, durability, and comfortability may enable adoption of sEMG in daily life.

Poster 21

Presenter: Seth Hall (Brigham Young University)
Mentor: Ravi Chandran (Metallurgical Engineering)
Improving battery capacity by using silicon as an anode

Lithium-ion batteries are used extensively in everyday life. Our project is to improve the capacity of these batteries. We are replacing the typical graphite anode with silicon, a material with a higher capacity and voltage. However, silicon expands almost 300% when lithiated. We are accounting for this expansion by etching micropores in the silicon.

Poster 22

Presenter: Andrew Spencer (Emory University)
Mentor: Man Hung (Family & Preventative Medicine)
The epidemic of adolescent e-cigarette use: Understanding how flavors, nicotine content, and marketing contribute to adolescent attitudes and health outcomes

Introduction: Adolescent e-cigarette use has increased dramatically in the last decade, with 27.5% and 10.5% of high school and middle school students reporting current use. Recent research has focused on improving our understanding of how certain e-cigarette product characteristics, such as flavor and nicotine content, exert influence on long term health outcomes, attitudes of harm perception, and usage patterns in adolescents. Three separate studies were conducted, one focused on e-cigarette flavor as a predictor of adolescent e-cigarette attitudes, another on nicotine content as a predictor of negative health outcomes, and lastly the influence of marketing patterns on adolescent e-cigarette attitudes. Methods: Data used for our analyses are derived from the youth Population Assessment of Tobacco Health (PATH) survey study, and was analyzed using SPSS Version 28 software. Results: Our flavor study returned no significant differences between e-cigarette flavor type initiation and dependence and harm perception. Additionally, increased nicotine content was associated with an increased likelihood of past year diagnosis of high blood pressure, high cholesterol, wheezing, dry cough, COPD, chronic bronchitis, loose teeth, lost bone around teeth, and gum disease. Lastly, our marketing analysis found that exposure to social media and newspaper advertising is most strongly associated with reduced e-cigarette harm perception in adolescents. When controlling for the effects of our covariates, the association between advertising exposure and reduced harm perceptions was decreased for all advertising forms. Conclusion: Our findings, taken together, suggest that risk factors for poorer long term outcomes include exposure to social media and newspaper marketing, using higher nicotine content, and initiating e-cigarette use with any common flavor, where traditional or non-traditional. There remains much research to be conducted in this field, but these findings provide several suggestions for minimizing the long term damage of this epidemic affecting adolescents worldwide.

Poster 23

Presenter: Trey Benally (The University of New Mexico)
Mentor: Lisa Joss-Moore (Pediatrics)
Effects of Uteroplacental Insufficiency on a Novel Splice Variant of PPARγ in the Rat Placenta

The placenta is an important mediator of fetal lipid acquisition. In cases of uteroplacental insufficiency (UPI), lipid droplets accumulate in the placenta and fetal lipid acquisition is impaired. Placental lipid metabolism is regulated, in part, by the transcription factor peroxisome-proliferator-activated-receptor (PPARγ). In UPI, PPARγ activity is dysfunctional, thus disturbing placental lipid metabolism and acquisition by the fetus. The activity of PPARγ in other tissues is modified by expression of a dominant negative isoform, resulting from the alternate splicing of exon 5 (PPARγΔ5). While the

importance of PPARγ in placental lipid metabolism is well appreciated, whether the placenta expresses the PPARγΔ5 variant, is unknown. We hypothesize that the PPARγΔ5 splice variant is expressed in the rat placenta. Rat placental cDNA was subject to PCR using primers targeted to exon 4 and 6 of the PPARγ gene. The PCR product was gel-separated and individual bands sequenced. PCR and subsequent sequencing demonstrate that both full-length PPARγ and the PPARγΔ5 variant are expressed in the rat placenta. Further, the splicing out of exon 5 results in a frame shift and introduction of a premature stop codon. In conclusion, the PPARγ splice variant, PPARγΔ5, is present in the rat placenta. Ongoing studies are measuring the effect of UPI on expression of this novel PPARγΔ5. Given that PPARγΔ5 is a dominant negative PPARγ variant, we speculate that UPI will increase expression of PPARγΔ5 thus contributing to pathogenic placental lipid metabolism in UPI.

Poster 24

Presenter: Kaelen Harris (University of Utah)
Mentor: Cynthia Burrows (Chemistry)
Investigation into Phosphorothioates

Investigation into Phosphorothioates
Phosphorothioates are synthesized in labs and naturally occurring within bacteria cells. These phosphorothioates can be used to prevent degradation of oligonucleotides. Examples of phosphorothioate selectivity amongst A, C, G, and T nucleotides are demonstrated. In this study we used high pressure liquid chromatography (HPLC) to illustrate alkylation selectivity amongst these oligonucleotides. We first produced alkylation products by reacting the DNA phosphorothioate with an iodoacetamide solution followed by an HPLC injection. The HPLC chromatograms show diastereomer product peaks. The overall goal of this study is to locate phosphorothioates in the human body. The future direction of this study is to sequence ribosomal RNA, ribosomes, and genomes with the MinION nanopore sequencer.

Poster 25

Presenter: Aashna Shah (University of Utah)
Mentor: Martin Tristani-Firouzi (School of Biological Sciences)
Characterizing the Role of CD320 in Vitamin B12 Uptake in IPSC's

The primary function of the gene, CD320, is to facilitate the uptake of vitamin B12 into cells. It is a cell surface receptor that specifically binds to a transcobalamin-vitamin B12 complex and moves it into a cell. It is ubiquitously expressed across all cell types. Vitamin B12 deficiency is linked to a number of health issues including heart disease. A study of a pedigree of one family with a history of structural heart defects shows that affected family members have damaging gene variants in 11 genes. Of these genes, CD320 is the only strong candidate for congenital heart disease. This study attempts to examine the interaction of CD320 with vitamin B12 using human induced pluripotent stem cells (IPSC's). The first part of the study is focused towards validating the existence of a CRISPR CD320 knockout line. Tests such as western blots to quantify protein expression and qPCR to quantify mRNA were carried out for this purpose. This study also focuses on creating and validating a vitamin B12 Elisa assay to study the effects of CD320 on vitamin B12 uptake. Once both aspects of this study are validated, experiments can be run to determine and quantify the effects that CD320, and absence thereof, can have on cellular vitamin B12 uptake as well as further downstream targets.

Poster 26

Presenter: Ye Zhou (University of Utah)
Mentor: Benjamin Sanchez (Electrical and Computer Engineering)
Non-invasive Diagnosis of Skin Lesions: A New Window Into Basal Cell Carcinoma

The goal of this project is to establish the reproducibility of the device and assess preliminary electrical impedance differences between basal cell carcinoma and adjacent normal skin area. In this study, we evaluated whether a new non-invasive electrical impedance spectroscopy (EIS) device could be a sensitive, objective and easy-to-apply method to assess

skin lesions to improve diagnostic accuracy. In this unblinded study, 17 subjects diagnosed with basal cell carcinoma (BCC) underwent four-electrode EIS measurements to assess the electrical properties of BCC and healthy skin. Data analysis of the measurements from seventeen patients was performed with R to assess the accuracy of this device.

Poster 27

Presenter: Morgan Adams (Florida State University)
Mentor: Lauren Barth-Cohen (Educational Psychology)
Students' framing when problem-solving in a think-aloud interview

The focus of this project was on students' epistemological framing while problem-solving in think-aloud interviews. An epistemological frame is a set of rules or expectations an individual has surrounding a problem or scenario which puts the problem into context and influences the individual's actions and reasoning. In these interviews, students with inquiry-based lab experience were given open-ended questions along with experimental data to interpret and were asked to narrate their thoughts and reasoning as they worked. In reviewing the interview recordings, we found that students typically fell along a continuum from numerical framing to trend-focused framing. Numerical framing involves a numeric manipulation of some kind as students problem solve, while trend-focused framing centers around concepts, trends, and behaviors while solving the problem. Half of the students went through the interview with a mostly trend-focused frame, with the other half of the students being split evenly between those who used a mostly numerical frame and those who used some blend of the two frames. Better understanding how students engage with data and representations can allow instructors to engage their students more fully in problem-solving during class or lab.

Poster 28

Presenter: Michael Martinez (University of Alaska Anchorage)
Mentor: Scott Summers (Nutrition and Integrative Physiology)
Role of Ceramides in Kidney Disease

American Indians & Alaska Natives have higher rates of kidney disease and failure than non-Hispanic whites. Currently, no therapeutic strategies are available to prevent the onset of kidney histopathology and progression toward organ failure. We have identified the bioactive sphingolipids termed ceramides as therapeutically targetable mediators of kidney disease. Renal ceramides associate with kidney disease endpoints, and pre-clinical genetic interventions to lower whole-body ceramides effectively prevent the onset of albuminuria and kidney fibrosis associated with diabetes. We conducted mechanistic in-vitro studies to investigate whether ceramides contribute to key features of disease progression: mitochondrial impairment, endoplasmic reticulum (ER) stress, and fibrotic signaling. We induced ceramide accumulation in human immortalized kidney cells and assessed effects on expression of ER stress and fibrosis markers and cellular respiration. Cells were incubated for 24 hours in media containing 0.5 mM palmitate with or without 10 uM myriocin; a potent inhibitor of the rate-limiting step in the de novo ceramide synthesis pathway. Alternatively, cells were treated with 50 uM C2-ceramide and compared with cells treated with C2-dihydroceramide, a ceramide precursor. Our preliminary data indicate that induction of cellular ceramides is sufficient to induce expression of inflammation and ER stress markers and impair mitochondrial respiration, which was not observed with induction of dihydroceramides or co-treatment with myriocin. Our work has elucidated a novel mechanism linking ceramides in kidney disease and could inform future therapeutic development to lessen the patient and public health burden caused by kidney disease.

Poster 29

Presenter: Dylan Hutchings (University of Utah)
Mentor: Trafton Drew (Psychology)
Searching Through Memory and Space for the Effect of Repeat Search

This research is investigating is the effect of repeat search on long term memory (LTM) encoding. It has been hypothesized that successfully finding a target would create an "attentional gate" (Josephs, Draschkow, Wolfe, Võ,2016).

Past research demonstrated that repeated searching improves memory in scenes (Draschkow, Wolfe & Vo 2014; Draschkow & Võ 2016; Joseph, 2016). Scenes are places like office spaces and grocery aisles. The researchers tested people's memory when asked to find objects within these scenes. To better understand the effect of repeat searches, our lab is investigating repeat searches without scenes. Testing participants in scenarios without scenes will isolate the effect of repeat searches.

Poster 30

Presenter: Rebecca Corley (University of North Georgia)
Mentor: Carsten Rott (Physics & Astronomy)
Breaking the Ice in Neutrino Physics: Camera Calibrations for IceCube Upgrade

Located within the Antarctic ice at the South Pole, the IceCube Neutrino Observatory is the world's largest neutrino detector. The detector comprises an array of photomultiplier tubes (PMTs) housed within glass spheres called Digital Optical Modules (DOMs), which are arranged in a 3D grid. The detector is built to detect light given off from the secondary charged particles emitted from neutrino interactions in ice. An extension of IceCube, the IceCube Upgrade, is planned in the coming years. The Upgrade is designed to measure low energy neutrinos and the optical properties of the ice with a novel camera system built by the IceCube collaboration. In this project, we generate Monte Carlo (MC) simulations of the Upgrade camera system subjected to various initial conditions. The ice properties of the refrozen hole, into which the Upgrade strings will be deployed, is studied specifically. The presence of bubble columns in the hole ice will lead to significant deviations in the measured neutrino properties. We try to characterize the ice properties by studying the camera response for different possible orientations of a bubble column.

Poster 31

Presenter: Tori Snyder (Presbyterian College)
Mentor: Carsten Rott (Physics & Astronomy)
Camera Hardware Tests for IceCube Upgrade

The IceCube Neutrino Observatory is a cubic-kilometer neutrino detector embedded into the ice of the South Pole. The detector consists of a 3D array of photomultiplier tubes (PMTs) grouped in spherical glass spheres called Digital Optical Modules (DOMs). The detector is designed to detect Cherenkov radiation emitted in neutrino interactions in ice. The charge, spatial and temporal distribution of the Cherenkov radiation is used to measure the energy and direction of the incident neutrino. Antarctic ice is ideal for measurements of this nature because the scattering length of light is much longer in pure ice than in other mediums. A low-energy extension of the detector consisting of 7 additional strings is planned in the near future. The upgrade will also include a better calibrated system in order to understand the optical properties of the ice and how the detector interacts with the ice. Cameras are an integral part of the new calibration system. This project explores the behavior of a camera system developed by the IceCube collaboration and characterizes the dark noise introduced in the setup. A further study with illuminated sources is in progress.

Poster 32

Presenter: Steven Marz (University of Utah)
Mentor: Andrey Rogachev (Physics & Astronomy)
Development of Optoadmittance Spectroscopy

Admittance spectroscopy characterizes the response of an electronic device to an applied oscillating voltage across a spectrum of frequencies. Optoadmittance spectroscopy is an extension of admittance spectroscopy designed specifically for opto-electronic devices. This method records the admittance spectrum for a light emitting device while also analyzing how the emitted light interacts with a photodetector. Preliminary tests using a Lumex yellow LED and Thorlabs Si photodetector were done at various DC offset voltages to vary the brightness of the LED across a frequency spectrum of 1 Hz - 1 MHz. The results show that changes in the admittance spectrum of the LED directly track to changes in the

optically coupled LED-detector system. This functions as a proof of concept, showing that the novel method can be further developed into a useful tool in characterizing experimental opto-electronic devices.

Poster 33

Presenter: Alice Ho (Carnegie Mellon University)
Mentor: Huiwen Ji (Materials Science and Engineering)
Li-Excess Rocksalt Oxides as Anodes in Li-ion batteries

Rechargeable Li-ion batteries are commonly used in many electronic devices- phones, computers, and even cars- but the graphite anodes normally used in these batteries have contributed to the batteries short-circuiting and catching on fire. Currently, the literature on better electrode materials in these batteries discovered new cathode materials with Li-excess, cation disordered, rocksalt structure, and new anode materials -complex metal oxides-with the shear Wadley-Roth phase improved the charge capacity and suppressed the phase transition contributing to the battery fires. The overarching purpose of this research was to explore these systems with conventional solid-state synthesis, x-ray diffraction, and electrochemical cycling to determine if these design principles work for anode materials. Results show that a Wadley-Roth type oxide (WRO) stored a high charge capacity of 240 mAh/g and that a Li-excess, cation-disordered, rocksalt oxide (LXCDRO) only stored about 44.4 mAh/g, but the former had worse voltage fade than the latter. As for anode material design, the features used to design cathode materials might not work for anodes, considering the poor electrochemical performance of LXCDRO. Future directions with this research include improving the long-term cyclability of WRO and synthesizing pure-phase LXCDRO in varied conditions to obtain a higher charge capacity.

Poster 34

Presenter: Rachel Pereira (Wellesley College)
Mentor: Taylor Sparks (Materials Science and Engineering)
Fluoropolymer Durability and Application in Wastewater Treatment Plants

Fluoropolymers are used in numerous industries including the chemical processing, automotive, aerospace, electrical, electronic, construction, and medical industries due to their unique combination of properties such as high chemical and thermal stability, non-stick properties, low dielectric constant, and mechanical strength. In this study, we explored a potential application of fluoropolymer coatings in wastewater treatment plants in order to prevent the fouling of pipes. In a second study, the degradation of fluoropolymer Kynar® PVDF was investigated by exposing the samples to harsh conditions such as high temperatures and different acidic solvents. While fluoropolymers have great potential to solve a number of industrial problems, understanding their limitations and ensuring their safe implementation is also of high importance.

Poster 35

Presenter: Simon Alexander (University of Oregon)
Mentor: Jessica King (Health, Kinesiology, and Recreation)
Tobacco Warnings around the World: Required Colors and Languages and their Association with Smoking Rates

Tobacco warnings are used around the world to educate consumers and potential consumers about the risks of product use. Warnings are typically displayed in one language or principle languages, which may limit the potential reach of warnings. Tobacco use is a leading cause of cancer worldwide. The purpose of this study was to conduct a content analysis of tobacco warnings used around the world, to determine the language reach and its effectiveness. We identified the languages and colors used in tobacco warnings, primary and secondary spoken languages, smoking rates, and income for 126 countries. Information was obtained from The World Factbook, Tobacco Atlas, Tobacco Free Kids, Tobacco Control Laws, WHO FCTC, and government websites. We conducted descriptive analyses to characterize the sample. T-tests were conducted to determine whether having warnings in multiple languages or color text warnings were associated with smoking rates and literacy rates, with analyses stratified by country income. The analysis displayed that 37.8% of the

countries require warnings to be in multiple languages. 32.4% of the countries require colored text to be displayed on tobacco packaging. Among country incomes, high-income countries have lower smoking rates because 19% require multiple languages and 20.7% require color text warnings. Further research is needed to conduct language and color text warning efficiency. Colors are a good attention grabber to potential consumers from a far. However, are principal languages blocking the reach? The next step needed for further analysis is comparing the required languages to the population that speaks that required language to identify the potential reach.

Poster 36

Presenter: Jaden Miner (University of Utah)
Mentor: Peter Armentrout (Chemistry)
Influence of C-terminus Methylation on the Dehydration and Deamidation of Protonated Asparagine-Serine

Previous work shows that for di-peptides with a hydroxyl moiety in their side chain, dehydration occurred from the side chain and backbone rather than the C-terminus as would be expected. This work aims to confirm whether this novel dehydration pathway is preferred by methylating the C-terminus of Asparagine-Serine, thereby shutting down the dehydration pathway from the C-terminus.

Poster 37

Presenter: Maya Wagner (University of Utah)
Mentor: Daniel R. Wik (Physics & Astronomy)
"X-raying" Galaxy Cluster Abell 2319: Understanding Its High Energy Components

Galaxy clusters are the largest gravitationally bound objects in the universe, containing hundreds to thousands of galaxies, which grow by merging with other galaxy clusters. Within galaxy clusters, galaxies make up a small portion of the total mass. Hot gas-part of the intracluster medium (ICM)-exists between the galaxies and emits light in the X-ray regime. *NuSTAR* is a X-ray satellite whose mission includes the study of ICM. This poster details the *NuSTAR* observation of Abell 2319 (A2319), which is a galaxy cluster undergoing a merger event. The goal is to understand the merger aftermath inside the ICM. Relativistic particles and magnetic fields in the ICM produce radio halos and X-rays due to Inverse Compton (IC) scattering. *NuSTAR* is the best telescope for analyzing IC emission, since it measures at high X-ray energies, where non-thermal IC emission dominates over thermal Bremsstrahlung emission produced by the ICM. The magnetic field of a galaxy cluster can be constrained using data from its radio halos and IC emission. Magnetic field strength in clusters is poorly understood, so constraints on it are vital. Components of the background were analyzed prior to selecting regions of interest used to understand components of A2319. The Xspec program helps analyze data; via xspec, multiple models can be fitted to selected regions. While there isn't enough evidence to make firm conclusions about A2319's ICM, preliminary evidence cannot confirm nor rule out detection of IC emission. A2319 contains complex temperature structure thus improved models are necessary for exploring IC existence. Future work will clarify this inconclusivity through a temperature map. This map helps to explicitly determine the temperature structure within A2319. Through this process, it will be straightforward to determine IC existence and its constraints. From either a detection or upper limit on IC, estimations of the global magnetic field in the ICM will be determined.

Poster 38

Presenter: Roger Woolley (Brigham Young University)
Mentor: Matt Bettini (School of Biological Sciences)
CAR T-Cell MycTag Insertion: A Tool for ITAM Mutant analysis on CAR T-Cell Durability

Chimeric Antigen Receptor (CAR) T-Cell immunotherapy is a targeted line of attack in the fight against a variety of cancers including B cell malignancies. While CAR T-Cell therapy has promise, various factors impede the T-Cell durability such as persistent antigen exposure, T-Cell exhaustion and regulatory cytokines. After a CAR interacts with its ligand, numerous proximal and distal signaling proteins are differentially recruited and determine cell fate. Detection of

individual signaling molecules can be visualized with existing lab procedures, while recruitment of proteins associated with individual CAR mutants have not yet been analyzed. We hypothesize that the insertion of a MycTag into the CAR constructs will allow for Immunoprecipitation (IP) Western Blot analysis of signaling proteins associated with the cytoplasmic immunoreceptor tyrosine-based activation motifs (ITAMs), giving greater insight into CAR T-Cell signaling. Following a restriction enzyme digestion, and using In-Fusion HD Cloning, a MycTag gBlock sequence was inserted upstream from the Variable Light region of the CAR antibody. Sanger Sequencing was used to verify correct insertion of the Myc insert into the vector. After transfection into T-Cells, IP Western blot analysis of local signaling pathways of CAR ITAM mutants. Analysis of specific proteins associated with the CD3Z ITAM such as PLCy1, Zap70 and LAT.

Poster 39

Presenter: Bennie Martinez (University of Utah)
Mentor: Katherine Baucom (Psychology)
Dimensions of Race: Understanding the Discrepancies in Race Data Collection for Hispanic & Latinx People in America

I'm doing research on Hispanic & Latinx demographics. Current measurements of race are not yet standardized to the level they could be. The 2020 US census utilizes categories of mutual exclusion whereby respondents must select one (or more) race(s), prefaced by an ethnicity question, enumerating or denying Hispanic/Latinx origin. According to the PEW research center, only about 53% of surveyed Hispanic participants felt as though this format appropriately captured their racial identity, whereas 100% of White respondents and 97% of Black respondents felt similarly. This, among a growing mound of research, indicates that something is remiss regarding the institutional and laymen understandings of race among Latinx people. Extant research remains unconsolidated despite calls for standardization within race and ethnicity demographic collection. That is the gap my research hopes to fill. Synthesizing ideas and work that predates me, I stand upon the shoulders of recent scholars in taking pieces from their puzzles and standardizing the strongest, most respectful, and accurate method of collecting race and ethnicity data. There exists far more than one facet of an individual's racial identity, including their skin color, their origins, their language, their features, how society racializes them, how individuals racialize them, et cetera. My hope is to provide recommendations on how to collect race data most efficiently, while explaining why an understanding of the multiplicative dimensions of race is an absolute requisite for any level of race data collection. Further, I provide arguments on why criticisms against self-identification do not hold enough weight to prevent standardization and empirical journeys into abandoning mutually exclusive categories.

Poster 40

Presenter: Mya Coleman (Spelman College)
Mentor: Annelise Poss (Human Genetics)
Ceramides as Lipotoxic Mediators of NAFLD/NASH

Incident non-alcoholic fatty liver disease (NAFLD) and subsequent progression to non-alcoholic steatohepatitis (NASH) are the hepatic manifestations of metabolic syndrome and represent an unmet therapeutic need. Ceramides are a lipotoxic mediator underlying diabetes, hepatic steatosis, and heart disease. A series of rodent studies reveal that reducing ceramide levels in mice prevents hepatic fibrotic progression, suggesting a therapeutic role for ceramide reducing strategies in the treatment of NAFLD/NASH. However, the cell-type specific actions of ceramides in the context of NASH have not been elucidated. Human hepatoma (Hep3b) and immortalized human stellate (LX-2) cells were used to understand the consequences of gain and loss of ceramides in these two liver-derived cell lines including incubation in palmitate, carbon tetrachloride, and C2 ceramide to elevate ceramide concentrations and treatment with myriocin, a potent inhibitor of the *de novo* ceramide synthesis pathway. Using gene expression as a readout, we evaluated markers of collagen synthesis and endoplasmic reticulum stress in all experimental paradigms. Future studies more fully characterizing the consequences of gain and loss of ceramides in conjunctions with cell type-specific knockout of ceramide synthesis enzymes will more fully elucidate the role of ceramides in hepatic cell types and NASH progression.

Poster 41

Presenter: Sarthak Tiwari (University of Utah)
Mentor: Edward DiBella (Radiology & Imaging Sciences)
Deep Learning for Age Prediction with Diffusion MRI

Brain age predictions are an important tool in predicting health and potential diseases such as Alzheimer's or HIV. Brain age is characterized by size changes to cerebrospinal fluid (CSF) and gray matter, as well as microstructural changes to white matter. An accurate method of estimating the age of healthy patients is necessary before imaging can predict the development of diseases. The best current approaches use T1 weighted MRI images and 3D convolutional neural networks (CNN) to predict age using changes in CSF and gray matter. Diffusion MRI using 3D CNNs may provide better predictions because it can characterize white matter in addition to CSF and gray matter. We used 204 healthy female subjects aged between 36 to 78 years from publicly available data from the Human Connectome Project in Aging (HCPA). For processing, a separate trained network allowed significant reductions in scan and processing time. This network produced 11 diffusion parameter maps of each subject, which we trained on the network separately. Our network could distinguish the age of the testing set with a mean absolute error of 5-10 years based on which parameter was trained. The best parameters were ones related to CSF size. Parameters based on white matter microstructure also worked, but less well. These results are comparable to many of the current methods for diffusion or T1 imaging. A 3D CNN with diffusion imaging allowed us to predict age with similar accuracy to T1 studies with much larger datasets. Diffusion imaging has the potential to accurately predict age for clinical uses. The use of a separate network for estimating parameter maps allowed for significant reductions in scan and processing time. Fast and accurate age estimations are necessary for imaging to predict age-related health outcomes. Future diffusion MRI studies combining multiple parameter maps could predict age with greater accuracy by simultaneously looking at CSF, gray matter, and white matter.
HCPA data used in the preparation of this abstract were obtained from NIMH, NDA. Dataset identifier(s): 10.15154/1522592.

Poster 42

Presenter: Shannon Lamb (University of California, Davis)
Mentor: Melissa Cortez (Neurology)
The Automation and Manufacturing of a Medical Device that Tests Chromatic Photophobia Threshold in those with Migrainous Photophobia

One of the key diagnosis criteria for migraine disorders is abnormal sensitivity to light, also known as photophobia. Patients with migraine disorders have a significantly lower photophobia threshold compared to healthy controls (Cortez et al., 2017, p. 801), however, there is very little known about the effects of colored lights on one's photophobia threshold. Therefore the Autonomic Physiology Laboratory at the University of Utah is developing a device to test chromatic light sensitivity threshold in those with migraines. The ideal device is an automated system of color-changing LED lights that would increase in Lux values (<20 lux to >10,000lux) incrementally every two seconds, measure the lux values at every interval, encapsulate one's full range of vision, respond to participant feedback, and export results of testing for analysis. Each participant will have three trials of white, red, green, and blue light. The LEDs are increased incrementally using pulse width modulation (PWM), a voltage output in a square wave rather than continuous, from 0% to 100% of the duty cycle. When the light intensity first becomes uncomfortable to the participant, they press their button for two seconds and the current lux value is logged. When the light intensity becomes a moderate pain, the participant presses their button a second time, the lux value is logged, and the lights turn off. The lux values are collected using a BH1750 sensor. The chromatic element of the device is altered using red, green, and blue light filters. The entire device is programmed using Arduino.io in conjunction with PLX DAQ which allows the serial data to be directly uploaded to a data sheet. Future research utilizing this device might be able to prescribe personalized tinted glasses that limit the effects of photophobia within patients with migraine and headache disorders.
Cortez, M. M., Rea, N. A., Hunter, L. A., Digre, K. B., & Brennan, K. C. (2017). Altered pupillary light response scales with disease severity in migrainous photophobia. Cephalalgia : an international journal of headache, 37(8).

Poster 43

Presenter: Elizabeth Sterner (Arizona State University)
Mentor: Jay Mace (Atmospheric Sciences)
Air Mass History of Southern Ocean Cloud Droplet Number Concentrations

There is a known relationship between CCN concentrations cloud lifetime via suppression of precipitation processes (Albrecht, 1989) and a correlation between atmospheric pressure and air mass trajectory. Air mass trajectory is then correlated to processes causing new particle formation over the continent, or no new particle formation over the open ocean (Humphries et. al., 2016). Are there differences in air mass history between cases of high and low concentrations of cloud droplet number (N_d)? MODIS cloud products were used to calculate particle number density using Grosvenor's method (Grosvenor et. al., 2018). Histograms of cloud microphysics were created and organized into cases of high N_d and low N_d based on the frequency distribtution of Nd derived from MODIS data along the East Antarctic shelf during summer 2018. Hysplit backwards trajectories were run on these cases 3 days back to track the air mass history and MODIS data were examined along these back trajectories to examine how the cloud properties evolved in time. In the high trajectory case study, liquid water path remained generally the same, cloud droplet number increased, and layer mean effective radius slightly decreased during the backwards trajectory. In the low trajectory case study, due to drizzle, liquid water path and cloud droplet number decreased over time. We suspect that biogenic sulfate aerosols derived from precursor gasses in the highly productive Antarctic Shelf waters in the summer months nucleate during passage of the air masses over the Antarctic ice sheet that then suppresses precipitation over the high latitude Southern Ocean in a way that does not happen over the open oceans further North.

Poster 44

Presenter: Abraham Tekoe (Western Kentucky University)
Mentor: Jim Steenburgh (Atmospheric Sciences)
Climatology of Snow to Liquid Ratio in the Central Wasatch Mountains of Northern Utah

Snow to liquid ratio (SLR) is the percentage of snow that is water. SLR is important for snow forecasting, and it differs from storm-to-storm and place-to-place across the United States. Every year, according to the U.S. Department of Transportation, more than 365,000 vehicle accidents, 138,745 injuries, and 1,705 fatalities occur during winter precipitation or snow. According to the National Research Council, airports delays and annual winter road maintenance also cost at least $5 billion each year. The purpose of this research is to determine the characteristics of SLR in the central Wasatch Mountains in Northern Utah; by analyzing observations from three sites in the upper Little Cottonwood Canyon [Alta Collins (CLN), Alta Central (ALTA), Alta Guard (AGD)] and two sites from Big Cottonwood Canyon [Spruces (BCC) and Silver Lake Brighton (SLB)]. After basic control of the observations, we focused on daily (24 hour) snowfalls ≥ 4 inches with water equivalent ≥ 0.1 inches. We found that the median SLR at the five sites ranges from 12.3 to 13.3, with Alta Guard the lowest (12.3) and Spruces and Alta Collins the highest (13.3). The National Weather Service Coop sites (SLB and ALTA) observed the most days of high SLR, which may reflect precipitation gauge bias. We also found that although Alta Guard and Alta Central are just 100 m apart, their SLR distributions and medians (12.5 at ALTA and 12.3 at AGD) differ, which could be the result of measurement practices or site characteristics.

Poster 45

Presenter: Lydia Altamiranda (University of Utah)
Mentor: Shiela Samson (School of Biological Sciences)
NKX2-1 controls cancer progression by limiting ERK activity

The RAS→RAF→MEK→ERK MAPK pathway is hyper-activated in a significant fraction of carcinomas, including ~50% of human non-small cell lung cancer(NSCLC). Optimal ERK activity drives malignant transformation, while excessive signaling induces cellular toxicity and senescence. KRAS mutation in mice induces low ERK activation that requires

additional mutations for high ERK activity and NSCLC progression (1-5). The mechanisms by which tumors overcome ERK's homeostatic feedback mechanisms to acquire high ERK activity include RAS amplification(1, 6), but are otherwise unresolved. The transcription factor NKX2-1/TTF-1 is downregulated in ~20% of lung adenocarcinomas (LUADs) and confers a worse clinical prognosis (7, 8). We tested if NKX2-1 is part of ERK's feedback mechanism and if it inhibits tumor growth and metastasis. We show that NKX2-1 induces the ERK negative regulators DUSP6 and SPRY2; reduces cell proliferation, migration and invasion in vitro; and reduces ERK activation, tumorigenicity and metastasis in vivo. Thus, NKX2-1 silencing during NSCLC progression unleashes ERK hyperactivation and LUAD progression through the loss of ERK feedback inhibitors.

Poster 46

Presenter: Rachel Compton (University of Utah)
Mentor: Anandh Babu Pon Velayutham (Nutrition and Integrative Physiology)
Does Dietary Strawberry Activate Brown Fat in High-Fat-Diet Fed Mice?

The #1 cause of death worldwide: cardiovascular disease (CVD). $214 billion in health care costs. $138 billion in lost job productivity. Risk factors including hypertension, hyperglycemia, hypercholesterolemia, dyslipidemia, atherosclerosis, diabetes, and obesity have become commonplace. Studies indicate that half of the people you interact with on a daily basis have at least one of the three key risk factors for heart disease.

Now the question is what can be done. Because our societies' rapidly declining health reflects shifts in modern lifestyle, addressing dietary factors serves as an effective functional approach. Emerging evidence indicates that activation of brown adipose tissue (BAT) reduces many CVD risk factors. Indeed, BAT activation may be a potential strategy for the prevention and/or treatment of CVD. Our lab recently showed that dietary supplementation of strawberry suppresses vascular inflammation (a key step involved in the development of atherosclerosis) in diabetic and high-fat diet fed mice. However, it is unknown whether this improvement in vascular complication is associated with increased BAT activity. We aim to discover the mechanism whereby strawberry supplementation improves vascular health and its relationship to BAT activation.

Poster 47

Presenter: Madeika Vercella (University of Utah)
Mentor: Stavros Drakos (Internal Medicine)
Carnitine Palmitoyltransferase (I & II) Abundance Prior to Heart Failure

Mitochondrial pyruvate carrier 1 (MPC1) is a cardioprotective transport protein participating in glycolysis in failing adult hearts. When MPC1 is genetically deleted, fatty acid oxidation (FAO) flux increases prior to heart failure (HF). However, this metabolic alteration remains unclear. Carnitine palmitoyltransferase 1 (CPT1), an important enzyme in FAO, allows acyl long-chains to enter mitochondria for oxidation. Additionally, carnitine palmitoyltransferase 1 (CPT1) has shown to be an important enzyme in fatty acid oxidation (FAO). CPT1 also functions alongside CPT2 in the mitochondrial matrix, where both enzymes respectively help form acyl carnitines and replace acyl carnitines with coenzyme A during FAO. Thus, it is necessary to understand MPC1, CPT1, and CPT2's roles in cardiac substrate utilization prior to HF. The aim of this investigation is to determine if deletion of MPC1 alters CPT1 and CPT2 abundance prior to the onset of HF in MPC-KO mice. We hypothesize that deletion of MPC1 upregulates both CPT1 and CPT2. The MPC1 gene locus was targeted in C57Bl/6 mice by placing loxP sites in the introns flanking the exon 3-5 of MPC 1 genomic locus. To induce deletion of MPC1, we injected tamoxifen (40 mg/kg) at 8 weeks old. 4 weeks post-injection, protein was isolated from WT (n=6) and MPC-KO (n=6) for quantification and western blotting of MPC1, CPT1, and CPT2. Western blotting of MPC-KO mouse hearts confirmed significant ($p<0.001$) cardiac specific protein deletion. However, MPC1-KO mice showed non-significantly ($p=0.20$) lower abundance (0.71±0.94 a.u.) of CPT1 compared to WT mice (0.32±0.35 a.u.). MPC1-KO mice also showed non-significantly ($p=0.28$) lower abundance (0.10±0.13 a.u.) of CPT2 compared to WT mice (0.16±0.22 a.u.).

Although non-significant, deletion of MPC1 downregulated both CPT1 and CPT2. Further investigation into the relationship between glycolysis and FAO substrate utilization prior to the onset of HF is warranted.

Poster 48

Presenter: Chloe Jones (Carleton College)
Mentor: Matthew Miller (Biochemistry)
Determining Stu2's Golden Ticket back into the Nucleus for Chromosome Segregation

For a cell to properly function, it needs to inherit the correct number of chromosomes during cell division. A major machine called microtubules pull chromosomes to each separate daughter cell. Kinetochores also assist in accurate chromosome segregation by binding to chromosomes and microtubules. The focus of my project was Stu2, a protein in budding yeast that interacts with kinetochores to correct erroneous attachments of chromosomes to microtubules. Using fluorescent microscopy, we determined the sequence that signals Stu2's journey back into the nucleus following protein synthesis which is regulated through phosphorylation and Stu2's ability to homodimerize. Studying the process of chromosome segregation has implications for cancerous cells in yeast cells which have analogous systems in human cells.

Poster 49

Presenter: Kiley Hewitt (Allegheny College)
Mentor: Karen Eilbeck (Biomedical Informatics)
Delivering Newborn Screening Variant Results To Clinical Specialists

Newborn screening (NBS) is a public health initiative with the goal of identifying infants with life-threatening but treatable disorders before the onset of symptoms. Each year, NBS detects thousands of potentially life-threatening conditions in infants. The current NBS panel includes a number of disorders (e.g. cystic fibrosis, PKU, galactosemia) that are primarily screened for using biochemical assays however newer disorders included on the panel lack robust biochemical markers (e.g. pompe disease, MPS I) for detection and may rely on genetic testing for confirmation of the disorder. In cases where a newborn screens abnormal for a disorder, they are referred to a clinical specialist (e.g. pediatric pulmonologist) for confirmatory testing, diagnosis, and treatment. Recently, the Utah NBS Program developed and is piloting a universal NGS-based method for secondary screening. Ideally, these results would be shared with the clinical specialist along with the biochemical NBS results to help them with clinical decision making. However, there is currently no mechanism for sharing these results beyond a PDF-based format which is how current NBS results are reported to clinicians. The goal of this project was to develop a prototype application for the reporting and reuse of NBS genomic variant results to clinical specialists using Fast Healthcare Interoperability Resources (FHIR). FHIR is a healthcare standard that represents specific data artifacts found in typical clinical scenarios (Patient, Condition, Encounter, etc.) as standardized "resources" with these resources being linked together via identifiers to provide a standardized and robust representation of clinical events. This prototype is based on another prototype application, ResultsMyWay, which is geared towards the delivery of NBS results and information to parents. Next steps for this project include the incorporation of this method into ResultsMyWay as the provider-facing portal. This type of application that allows for electronic reporting and reuse of data has the potential to improve the care of newborns.

Poster 50

Presenter: Max Austin (University of Utah)
Mentor: Andrew Roberts (Chemistry)
Small molecule methods for peptide macrocyclization

In recent years, macrocyclic peptides have gained great interest in medicinal chemistry and chemical biology due to their unique stability in-vitro compared to their linear precursors, thus making them robust candidates in drug design [1, 2]. Inspired by Nature's wide collection of non-ribosomal peptides, we are developing new chemical strategies for the synthesis of cyclic peptides. One cyclization method leverages the inherent reactivity of the tyrosine (Tyr) phenol nucleus

with electrophilic 1,2,4-triazoline-3,5-dione (TAD) moieties. Using this reaction, we can construct macrocyclic peptidomimetic scaffolds [3]. A separate strategy of performing cyclization is via amide-coupling (i.e., peptide ligation). Though many methods of ligation have been developed1 and there have been several improvements regarding reaction efficiency, the challenge of site-specificity remains. We hypothesize that a tetrahydroisoquinoline-based small molecule may aid in the process via utilizing a system of N,S-acetals to facilitate ligation through transthioesterification and amine capture, followed by S- to N-acyl transfer [4]. We are working on developing reaction conditions for organocatalysis and applying the method to access natural peptide macrocycles.

Poster 51

Presenter: Momina Sial (University of Utah)
Mentor: Jessica King (Health, Kinesiology, and Recreation)
How do State Taxes on E-cigarettes Affect Recreational Usage Amongst Teens in the US?

The rise in popularity of e-cigarettes amongst teenagers in the US has evolved into a serious concern for policymakers. The harmful effects of nicotine usage, especially amongst youth, raises concerns of the long-term effects that e-cigarettes are known to have. Although age and flavored e-cigarette bans have been enacted, the amount of teenagers using e-cigarettes is still alarmingly high. The urgency of the issue calls for more research on the effectiveness of policies that could drive down usage, such as the e-cigarette state taxes which are currently enacted in 23 states and the District of Columbia. Determining whether or not these taxes are effective is crucial in providing the evidence needed to make informed policy decisions that will directly affect the public health of America's youth.

Poster 52

Presenter: Ramy Yousef (Hendrix College)
Mentor: Eric Pardyjak (Mechanical Engineering)
Using Low-Cost Sensors to Detect UVA

Ultraviolet light (UV) is a form of electromagnetic radiation that consists of three types: UVC, UVB, and UVA. Sources of UV include the sun and tanning beds. UV has positive and negative health effects on human beings. While UV does initiate vitamin D synthesis, UV is also primarily responsible for skin cancer (Fioletov et. al, 2003/2010). Skin cancer is so prevalent that it's estimated that 1 in 5 Americans will develop skin cancer by age 70 (Skin Cancer Foundation, 2021). We must educate the general public about UV to combat skin cancer and make UV readings easier to obtain. The LEMS (Low-cost Energy-budget Measurement Station) is a cheap, solar-powered weather station that measures multiple variables including temperature and solar irradiance (Gunawardena et. al, 2018). The purpose of this research project was to develop a model that allows the LEMS to indirectly measure UVA using the Li200R pyranometer. While the Li200R does not measure UVA, we used linear regression to devise a model that can output an estimate of UVA based on the Li200R's reading. To accomplish this, we took measurements using the Li200R pyranometer (measures in the 400-1100 nm range) synchronously with a UVA instrument (300-400 nm). The results show that the linear regression model is adequate since the R2value is high and the confidence intervals are narrow. These findings show that we can develop accurate models to measure UVA indirectly, and these findings can be used to increase public knowledge of UV to hopefully reduce skin cancer rates.

Poster 53

Presenter: Isabel Chosco (California State University, Northridge)
Mentor: Aaron Quinlan (Human Genetics)
Empirical characterization of internal priming in single-nucleus RNA-seq data

Transcription in eukaryotic cells involves a complex series of RNA processing steps that include capping the 5' end, polyadenylation of the 3' end and co-transcriptional splicing. Prevailing single-cell RNA sequencing methods are designed to target the poly-A tail 3' end of the transcript and are therefore only analyzed at the gene level. However, pre-

mRNAs include introns that often contain adenine homopolymers which have been shown to act as a non-canonical hybridization site through a phenomenon called "internal priming". One consequence of internal priming is inflated estimates of transcription when a given transcript is hybridized at both the polyA and internal priming site(s). Therefore, multiple methods have been devised to predict internal priming sites for each gene and to adjust the counts based upon the number of predicted internal priming sites. However, these approaches use arbitrary and inconsistent definitions of potential internal priming sites and therefore do not adjust counts based upon whether a predicted internal priming site is used. The focus of our research is to develop an empirical model of how often putative internal priming sites are used. We will identify clusters of reads along the gene, identify internal priming sites, and characterize the sequence content of the priming site in relation to read intensity. This will not only improve the adjustment of read counts arising from internal priming, but also enable direct studies of co-transcriptional splicing by identifying more or less abundant introns than expected from the empirical sampling model.

Poster 54

Presenter: Ashley Henderson (University of Utah)
Mentor: Taylor Sparks (Materials Science and Engineering)
Developing Benchmark Data for Efficient Comparison of Machine Learning Models for Materials Discovery

Materials discovery via machine learning has become an increasingly popular method due to its ability to rapidly predict materials properties in a time-efficient and low-cost manner. However, one limitation in this field is the lack of benchmark datasets, particularly those that encompass the size, tasks, material systems, and data modalities present in the materials informatics literature. This makes it difficult to identify optimal machine learning models including algorithm, model architecture, data splitting, and data featurization for a given task. To address this issue, this research focuses on assembling a unique repository of 57 different datasets for materials properties. The data contains both experimental and computational data, data suited for regression as well as classification, sizes ranging from 12 to 83,987 samples, and materials systems spanning the diversity of materials research. Data were extracted from 16 past publications and the 2018 Materials Project database. In addition to cleaning the data where necessary, each dataset was split into train, validation, and test splits. For publication datasets with more than 100 values, train-val-test splits were created, either with a 5-fold or 10-fold cross-validation method, depending on what each respective paper did in their studies. Publication datasets with less than 100 values had train-test splits created using the Leave-One-Out cross-validation method. Alternatively, all of the Materials Projects datasets had train-val-test splits created with a 70-15-15 split. These benchmark data can serve as a basis for a more diverse benchmark dataset in the future to further improve their effectiveness in the comparison of machine learning models.

Poster 55

Presenter: Tay Stevens (Queens University of Charlotte)
Mentor: Isak Goodwin (Surgery)
Nerve Distribution in the Glans Penis Instructs Male-to-Female Gender Affirming Clitoroplasty

The current procedure for transgender male-to-female vaginoplasty requires clitoroplasty. This includes taking a small section of the glans penis, approximately 8x8 mm, which forms the neo clitoris for optimal sensation for the patient. The sensate clitoris is created by using the innervation of the glans of the penis. This study aims to identify the areas of the glans penis where the sensory nerves are most dense or numerous for transgender male-to-female vaginoplasties. This improvement will be standard instruction for future clitoroplasty procedures. This study uses cadaveric glans specimens from the University of Utah School of Medicine Body Donor Program. The glans specimens are embedded in paraffin wax blocks and sectioned into proximal, middle, and distal sections. The glans specimen is marked with colors for orientation. Each area has 5-6 sections, approximately every 500 um. For each section, samples will have H&E and immunohistochemical (IHC) analyses (PG9.5 with a 1:2,000 dilution). PG9.5 is a nerve-specific stain that will allow quantification of the nerves in the specimen. IHC stained slides will be analyzed with software to identify the areas of greatest nerve density. This will inform future design in male-to-female clitoroplasty.

Poster 56

Presenter: Paige Murray (Willamette University)
Mentor: Krista Carlson (Metallurgical Engineering)
Degradation of Polystyrene Nanoparticles by Titania Nanotube Anodes

The average American consumes about a credit card worth of plastic per week. Small nano-sized polymer particles have been shown to infiltrate cells in the body and impact their function, making them a danger to public health. Previous research has shown electrocatalytic oxidation using substoichiometric titania anodes as an effective, chemical-free method of pathogen disinfection. This paper offers a strategy to combat microplastic pollution in water by degrading the microplastics using an electrocatalytic water disinfection device that destroys nano-sized polystyrene particles utilizing an anode with an n-type doped titania (n-TiO2) nanostructured surface.

Poster 57

Presenter: Wilber Dominguez (Swarthmore College)
Mentor: Kyle Dawson (Physics & Astronomy)
New Age of Cosmology with DESI

Using new spectral data from DESI, we studied the consequences of errors in redshift measurements derived from photometric imaging. We used a newer method of red sequence galaxy selection by utilizing the infrared W1 magnitude and the r-W1 color. This can give us insight on how galaxies of different mass and age cluster. Preliminary results show that galaxies separate more cleanly when using the infrared band, as opposed to the traditional g-r color. From our selection of red sequence LRGs the clustering amplitude is five times higher than the LRGs that lie outside of the red sequence.

Poster 58

Presenter: Arun Acharya (Brown University)
Mentor: Mallory Thomas (Chemistry)
Characterization of MONDO-A and TXNIP in Immortal Human MB135 Myoblasts.

The rate of new cases of cancer is 442.4 per 100,000 men and women per year in the United States alone and is only increasing. Previous research has proved that glucose is essential for the differentiation and the proliferation of cancer tumor cells. MondoA is a glucose responsive transcription factor which regulates glycolic levels in the human body by down regulating Thioredoxin Interacting Protein (TXNIP). This relationship between MondoA and TXNIP results in a negative feedback loop and ultimately glycolic homeostasis in the human body. Furthermore, one of the primary functions of the skeletal system is regulating glycogen making MB135, skeletal muscle cells, an excellent cell line for the characterization of MondoA and TXNIP. We used methods such as immunoblotting, mitochondrial staining, and immunofluorescence of MB135 as well as transcriptome profiling of SK-111 cells to better understand the characterization of MondoA and TXNIP in immortal skeletal muscle cells. My study has shown that MondoA knockout cells differentiate at a slower rate than TXNIP and parental MB135 cells. Understanding the glucose regulation mechanisms of MondoA and TXNIP can result in further development of various treatments for cancer.

Poster 59

Presenter: Rosemary Mwithiga (Dixie State Univeristy)
Mentor: Candace Floyd (Physical Medicine & Rehabilitation)
CANNABIDIOL ADMINISTRATION AFTER SPINAL CORD INJURY REDUCES ALLODYNIA IN BOTH MALE AND FEMALE RATS WITH THE MOST ROBUST EFFECTS ON FEMALEs

Chronic, neuropathic pain development post-spinal cord injury (SCI-NP) affects a vast majority of patients and lowers quality of life as there are few effective therapies for this condition. Clinically, cannabidiol (CBD) has had success in treating NP disorders and has been shown to have pleiotropic effects on many aspects that contribute to SCI-NP. The effects of CBD treatment on SCI-NP remain unknown, therefore the purpose of this study was to examine the therapeutic potential of acute administration of CBD on chronic outcomes post-SCI in male and female rats. Prior to surgery, baseline measures of motor and sensory function were taken. Animals were divided into surgical control (LAM) or injury (fifth vertebral level cervical unilateral injury). Thirty minutes post-surgery, animals received an intraperitoneal injection of either vehicle (Veh) or CBD, continuing once per day for 7 consecutive days.

Beyond this, CBD administration reduced autophagic behavior in both sexes and significantly reduced cold-induced sensitivity sub-acutely in males and chronically in females. Utilizing the Grimace Assessment, it was observed that facial grimace scores increased after acetone application in SCI animals. SCI increased incidence of contralateral hind paw withdrawal to cold stimuli but not mechanical force in males and females. These results indicate that CBD has some therapeutic efficacy in both sexes but confers greater protection in females.

Poster 60

Presenter: Ava Peitz (University of Utah)
Mentor: Ming Hammond (Chemistry)

The Need for Speed: Improving Turn-On Kinetics of the RNA-Based Guanidine Biosensor

RNA-based technologies are widely used in therapeutic, diagnostic, and biosensing applications. The mRNA vaccines developed to combat the novel coronavirus are a widely known example of RNA-based medical therapeutics. The Hammond lab is a pioneering group in RNA-based biosensor development for sensing metabolites, signaling molecules, and enzyme activity. These dynamic sensors, called RNA-based fluorescent biosensors, are composed of a ligand recognizing riboswitch domain and a fluorogenic dye-binding aptamer-domain. Selective ligand binding to these biosensors leads to conformation changes and induces fluorescence turn-on in both living and non-living systems.

One of the important aspects of the applicability of these biosensors is their activation-kinetics. To ameliorate biosensors' activations, we have come up with a base-pair mutation strategy with the hypothesis that base pair mutation will reduce any misfolding during the activation process and will enhance the turn-on kinetics. For this, we have chosen a recently developed guanidine biosensor composed of the guanidine riboswitch and the fluorogenic spinach aptamer. I've focused on pyrimidine-purine swapping single base-pair mutations of the guanidine biosensor RNA at four base-pair locations on the P1b stem of the riboswitch, where the nucleobases are not conserved or involved in ligand binding. Previous lab results showed that single base pair mutations are likely to improve turn-on kinetics at these locations. Mutated biosensors were synthesized by in vitro transcription reaction using T7 RNA polymerase. All four biosensors with single pyrimidine-urine swapping mutation show fluorescence turn-on upon guanidine addition. The kinetic study of these biosensors currently is in progress.

This approach can also be applicable to improve the response of other RNA-based devices. Results from this experiment will be a guide for other biosensors as the lab moves forward with developing biosensors for different target ligands, and will allow us to better understand the mechanisms of RNA-based technologies.

Poster 61

Presenter: Alec Kotler (Carleton College)
Mentor: Greg Ducker (Biochemistry)

The Effects of Asparagine Synthetase on Cellular Metabolism across Leukemia and Liver Cancer Cells

Cancer cells consume nutrients at high rates to sustain rapid proliferation, which can make them vulnerable to nutrient limitations in the tumor microenvironment. At the same time however, many tumor cells downregulate non-essential

metabolic enzymes in order to streamline their metabolism leading to a heightened reliance on extracellular nutrients. Asparagine synthetase (ASNS) is an enzyme that is often downregulated in different types of cancer leading to a dependence on asparagine. To explore how loss of ASNS rewires cellular metabolism, and if new vulnerabilities result from this, we used CRISPR screens to identify the aspartate utilizing enzymes ASS1 and CAD as synthetically lethal in ASNS-deficient leukemia cells. We next sought to expand this observation into ASNS-deficient liver cancer cells. Using q-RT-PCR, we measured the expression of genes related to asparagine and aspartate metabolism. In ASNS knockout (KO) leukemia cell lines, the arginine synthesis gene ASS1, and its transcriptional regulator, c-MYC, are decreased compared to wild type. In addition, arginine transporter (SLC1A3) and complex I members (NDUFA6/7) are increased. Mass spectrometry data corroborates this finding by confirming that arginine levels and NAD+ levels are increased. This result suggests an increase in arginine transport and shift towards glycolysis. These findings indicate the rewiring of ASNS deficient cells contribute to continued cell growth but also highlights vulnerabilities in these cells that can be targeted in the making of future therapeutics.

Poster 62

Presenter: Avery Wall (University of North Carolina at Chapel Hill)
Mentor: Jack Silcox (Psychology)
Effects of Divided Attention on False Hearing and Implications for Driving

Many people wouldn't think twice about talking on the phone while driving, but studies have found that listening to speech while driving can negatively impact driving performance (Strayer & Johnston, 2001). However, driving performance is not the only thing impacted by this divided attention: comprehension and memory of the speech are also impaired. False hearing is the phenomenon in which an individual believes they heard a word that makes sense in the context when another word was actually said, and this concept extends to memory as well. Research has suggested that false hearing and false memories become more common when there is interference that causes individuals to rely on reconstructive processes and make predictions about what they heard (Rogers et al., 2012; Watson et al., 2016). Because traffic noise may interfere with hearing while driving, individuals may be more prone to false hearing and false memories when driving. To explore these relationships, we are using two experiments: one that focuses on the impact of divided attention on false hearing, and a second that attempts to increase ecological validity by using a driving simulator. In both experiments, participants listen to sentences with the last word partially occluded by background noise and report what they hear. Participants simultaneously complete a secondary task (either a dot tracking task or a driving task), which allows us to identify how dividing attention impacts performance on both the speech and secondary task. Both projects are currently ongoing, but preliminary findings from the first experiment suggest that people are making predictions about what they heard based on the context, which is leading to high rates of false hearing. Though there does not appear to be a difference in performance between the divided and full attention conditions, a full sample is needed before drawing any conclusions, and we may see a different pattern in the second experiment that incorporates a more demanding task.

Poster 63

Presenter: Ashley Bates (University of Utah)
Mentor: Matt Wachowiak (Neurobiology & Anatomy)
Dopaminergic Signaling within the Olfactory Bulb

When an animal inhales an odorant, an action potential forms and travels through the axons of the receptor cells to the glomeruli structures within the OB. Dopamine (DA) is a neural transmitter that is released in the Short Axon Cells (SACs) located on the surface of the glomeruli. DA is synthesized by the enzyme Tyrosine Hydroxylase (TH) and regulates inputs and outputs of the olfactory bulb through exciting or inhibiting the function of the neurons. Glomerular signals are received by OB output mitral and tufted cells, which send an action potential to higher order brain regions. Decreased DA expression has been correlated with memory loss and the inability to control fine movements, common in Parkinson's and Alzheimer's disease. In our project, we carried out a learned behavior task in a mouse model to examine DA signaling in

vivo as well as immunohistochemistry (IHC) to evaluate TH expression. A passive odor exposure paradigm combined with IHC was also tested in a mouse model to evaluate changes in TH expression. Results from the learning paradigm showed an increase of TH expression, however there is no significant difference in DA signaling. Results from the passive odor exposure paradigm suggest there was a small increase in TH expression in mice exposed to an odor. In future experiments, focusing on one glomeruli may increase accuracy of the results and become more representative of TH expression and DA signaling. Additionally, reducing cage and bedding odor may allow for a more precise detection of TH expression from environmental odors.

Poster 64

Presenter: Kenyon Mitchell (Utah State University)
Mentor: Julio Facelli (Biomedical Informatics)
Point Mutations In Human ACE2: Their Effect On Binding Affinity With SARS-CoV-2 Spike Protein

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the cause of coronavirus disease 2019 (COVID-19). SARS-CoV-2 is an enveloped coronavirus that invades host cells using an endocytic pathway. The SARS-CoV-2 spike protein is the main viral protein that contributes to the fusion of the virus particle to the host cell by binding with angiotensin-converting enzyme 2 (ACE2) proteins on host cells. Various determinants of disease progression and presentation such as age, sex, virus mutations, comorbidity, lifestyle, host immune response, and genetic background variation have caused clinical variability in outcomes of COVID-19. Specific genetic factors contributing to different outcomes of SARS-CoV-2 infection are unknown. We Hypothesize variants in the ligand-binding sites of the ACE2 gene are potential genetic risk factors for COVID-19 infection. In this study, we assess if ACE2 polymorphisms affect the interaction between ACE2 and SARS-CoV-2 spike protein to ascertain contributing genetic factors of COVID-19. Our analysis of the eighteen natural ACE2 missense mutations with frequency 1.0x10^(-5) or greater within the human population show alterations in the structure of the ligand-binding domain and influence the binding affinity at the receptor-ligand interface. These findings may provide an explanation for the broad spectrum of COVID-19 presentations.

Poster 65

Presenter: Clista Galecki (University of Utah)
Mentor: Joel Harris (Chemistry)
Characterizing Antibody Association with Ligands Immobilized at Supported Lipid Bilayer Interfaces

The goal of this research is to determine how accessibility of recognition ligands at supported lipid bilayers impacts their association with antibodies in solution. Label-free methodologies currently used to characterize antibody surface association are unable to detect changes in the state of the recognition ligand. This information is crucial in assessing how factors like phospholipid bilayer phase may modulate accessibility of ligands to binding with solution-phase proteins. Here we describe the analysis of Immunoglobulin G (IgG) association at a supported lipid bilayer interface prepared with a ligand-modified (dinitrophenylated) lipid formed at porous silica surfaces. Characterizing the composition of the lipid bilayers within the porous silica with confocal-Raman microscopy, we first establish our ability to detect the presence of the ligand in bilayers prepared with modest mol-fractions (2 mol%) of a dinitrophenylated lipid. Demonstrating the platform's specificity, we test 1μM IgG against POPC and DPPC bilayers prepared with and without dinitrophenylated lipid and detect only IgG binding at bilayers prepared with the recognition-ligand. Equilibrating the IgG-bound samples with 100 μM 2,4-dinitophenol resulted in complete dissociation of the surface-bound IgG. Special attention to the 1527 cm-1 NO2 stretch of the ligand reveals reduction of the band intensity accompanied with a slight red-shift following association of IgG; recovery of the initial band features was observed following IgG surface-dissociation. Direct detection of the binding state of an interfacial recognition ligand marks a major innovation in the surface analysis of IgG surface association reactions. Having established specific protein accumulation and detectable changes in ligand state following binding, we next aim to use this insight to determine how lipid phase (gel or liquid crystalline) modulates the accessibility of the recognition ligand at supported phospholipid bilayer interfaces.

Poster 66

Presenter: Rachel Maguire (Southern Illinois University Carbondale)
Mentor: Mary Beth Scholand (Internal Medicine)
The Role of Autoimmune Panels in Interstitial lung disease

Interstitial lung disease (ILD) is a broad categorization of heterogenous fibrotic lung disorders affecting the interstitium and causing stiffness of the lungs, seen across the world. ILDs can be caused by a variety of factors, such as exposure to pathogens, environment, autoimmune diseases, and/or idiopathic (unknown) causes. Progression of ILD, leads to scarring and debilitation. This project aims to identify cytokines associated with ILDs, thus aiding with future ILD identification and diagnosis. Cytokines are used to better understand the pathophysiology of inflammatory, autoimmune, and infectious disorders. Finding a cytokine link to ILDs may provide significant information on the detection of these lung diseases. In this analysis, serologies will be obtained via blood samples of patients with known ILD using a cytokine panel testing the levels of 13 different cytokines. Based on this panel, this project proposes to characterize biomarkers associated with fibrotic diseases. Preliminary findings show a greater detection of IL-2 receptor and IL-10 cytokines, indicating they may play a role in ILD. Future data on these panels will give a greater understanding of the full breadth of potential biomarkers in ILD patients.

Poster 67

Presenter: Sam Ringham (Iowa State University)
Mentor: Sarah Franklin (Human Genetics)
The Role of SMYD5 in the Development of Heart Disease

Cardiac hypertrophy has often been caused by abnormal genes in the heart tissue. This hypertrophy causes the heart tissues to grow abnormally due to their increased workload. This abnormal growth is often related to various heart diseases. To solve this problem in gene expression, similar molecular structures to human heart tissues must undergo epigenetic changes to alter euchromatin and heterochromatin states to simulate up and down regulation of genetic pathways of heart hypertrophy. The Smyd5 protein has shown to downregulate hypertrophy in the heart via trimethylation of histone H4K20. Understanding the mechanism behind this phenomenon is essential in incorporating it into clinical applications. Finding binding partners of Smyd5 gives insight into how these epigenetic changes occur. This study aims to confirm the relationship between a known binding partner in the protein LMCD1 and Smyd5 via reverse CO immunoprecipitation with the use of H9C2 cells. Other methods involved would include: qPCR, westernblotting, and mass spectrometry. The results from this study would provide information as to the mechanisms behind the trimethylation of H4K20 and the down regulation of heart hypertrophy. Solving this problem of heart hypertrophy could lead to massive advancements in human medicine for the field of cardiology.

Poster 68

Presenter: Christian Fielding (University of Utah)
Mentor: Carol Lim (Pharmaceutics & Pharmaceutical Chemistry)
Localization and Potency of p53-Bad Constructs

p53-Bad is a novel gene therapy tumor suppressor. p53 is a protein that controls cell cycle arrest, DNA repair, and apoptosis in the nucleus. In the mitochondria p53 can induce rapid apoptosis. Because of this p53 is important for regulating the natural turnover of cells and avoiding tumors. By linking p53 to a protein called Bad, p53 can be delivered to the mitochondria. Bad is a protein with a MTS and a region that can activate pro-apoptotic pathways and deactivate anti-apoptotic pathways. Both p53 and Bad can activate pro-apoptotic pathways and block anti-apoptotic pathways, this gives the potential to avoid drug resistance due to multiple apoptotic pathways. Chemotherapy is the current standard of care and cancer can develop resistance. p53-Bad has already been shown to be able to activate apoptosis through intrinsic mitochondrial pathways, the purpose of this research was to compare different linkers between p53 and Bad. The linkers tested were a beta-turn linker, 3-alpha helices, a flexible linker of glycines, and a rigid linker of Prolines. The potency of

the constructs with the different linkers were tested using a flow cytometry machine and a red fluorescent chemical called 7-AAD. 7-AAD is only able to penetrate a disrupted cell membrane and all p53-Bad constructs were tagged with a green fluorescent protein. Using these two things a flow cytometry machine can determine how many cells were killed from the p53-Bad constructs. Because the flow cytometry machine was down for a large portion of the research period only one trial was attempted so no conclusions could be drawn. Another assay used was a microscopy assay. It was used to determine the localization of the constructs with the various linkers. p53-Bad constructs were again tagged with GFP, but in this assay the cells were stained with a red mitochondrial stain and a blue nuclear stain. Using a confocal microscope we were able to see the localization of the p53-Bad constructs. While we were able to run this test successfully not enough data was collected to draw a significant conclusion.

Poster 69

Presenter: April Radford (University of Utah)
Mentor: William Anderegg (School of Biological Sciences)
Quantifying Drought Vulnerability in Major Western US Tree Species

Climate predictions for the Western U.S. indicate that more frequent and severe droughts are likely to become increasingly common in coming years (Allen C.D. et al., 2015). With more frequent and severe drought come implications for the timber industry, outdoor recreation, and the general ecology and biodiversity of western U.S. forests. The objective of this research is to increase understanding of the physiology of ponderosa pine (Pinus ponderosa), white fir (Abies concolor), and jeffrey pine (Pinus jeffreyi) in order to determine which species are more and less vulnerable to drought. Roots and stems from plots in the National Science Foundation's (NSF) National Ecological Observatory Network (NEON) in Oregon and California were sampled and tested for hydraulic conductivity and vulnerability to embolism. Vulnerability curves from the roots and stems of each species were then compared in order to determine which species are more likely to be able to recover from drought events. Results indicated that the ponderosa pine root samples, collected in Oregon, are far more vulnerable to drought than stem samples from the same species and plot. The white fir and jeffrey pine samples collected in California, however, showed a far smaller difference in vulnerability from root to stem. This could be due to phenotype adaptation in response to growing in a generally hotter and dryer environment, however further research in genetics is necessary to confirm such speculation.

Poster 70

Presenter: Carolyn LaPrete (University of Utah)
Mentor: Frederick Adler (Mathematics)
Modeling Transmission of SARS-CoV-2 Within and Between Households

This project uses mathematical modeling to compare the dynamics of SARS-CoV-2 epidemics with varying groupings of individuals. Typical models treat the population as one group of individuals with a consistent rate of transmission, but SARS-CoV-2 is highly transmissible in close-contact settings, so transmission rates may be higher in group settings such as typical family households and various styles of congregate living. Extending a standard SIR model to account for these changes results in increases the peak of infection in an epidemic, an important factor in making outbreak mitigation decisions.

Poster 71

Presenter: Kyle Kazemini (University of Utah)
Mentor: Samir Abdelrahman (Biomedical Informatics)
Understanding the Changes of Patients in the Intensive Care Unit: A Case Study of Sepsis and Acute Kidney Injury

Sepsis is a dysregulated host response to an infection. This response may include tissue hypoperfusion, organ dysfunction, hypotension, hypoxia, and organ failure. Acute Kidney Injury (AKI) is defined as an increase in serum creatinine levels by at least 0.3 mg/dl or to 1.5 times baseline.

Development of AKI during sepsis increases patient morbidity, predicts higher mortality, has a significant effect on multiple organ functions, is associated with an increased length of stay in the intensive care unit, and hence consumes considerable healthcare resources. Although there are treatments for both conditions, it is imperative that clinicians start treatment early. We hope to understand the similarities and dissimilarities in sepsis and AKI patients in order to inform clinician interventions.

For our analysis, we use the Medical Information Mart for Intensive Care (MIMIC)-IV database, which provides critical care data for over 40,000 patients admitted to intensive care units.

Once we have credentialed access to the MIMIC-IV database, we use MySQL to query the data. We select 51 hourly time steps for ICU patients, which include patient information, vital signs, and sepsis and AKI outcomes. This data can then be transformed into a time series dataset.

We use a Python library called tslearn for machine learning on time series data. We choose the KShape clustering algorithm for its accuracy and efficiency. The KShape clustering algorithm will allow us to evaluate similarities and dissimilarities in sepsis and AKI patients using the clusters and other powerful evaluation tools such as silhouette scores.

In short, we have found similarities, but there is still work to be done to improve the quality of the clusters. We are considering adjusting the number of time steps, choosing different features to evaluate, and using different clustering algorithms such as KMeans, DBSCAN, OPTICS, BIRCH, or hierarchical clustering.

Poster 72

Presenter: Maddison Zollinger (Utah State University)
Mentor: Nichole Link (Neurobiology & Anatomy)
Identifying novel genes causative of human microcephaly through a Drosophila model

Microcephaly is a neurodevelopmental disorder that results in reduced brain volume and is caused by genetic or environmental factors. Patients with microcephaly often show developmental delay or intellectual disability and can be completely dependent upon others. Using information from microcephaly patients together with functional analysis in flies, we showed that mutations in *ANKLE2* are associated with reduced brain size in both humans and flies. Wild type human *ANKLE2* can rescue fly mutant phenotypes, but mutations found in human patients cannot. These results show the function of ANKLE2 is conserved and that mutations in *ANKLE2* cause microcephaly. Using this platform, our goal is to identify novel microcephaly-causing genes. Exome sequencing of a collection of 200 microcephaly patients identified genes that might be causative of this disease. We used these genes to identify candidate fly orthologs and tested if they were required during brain development. Previously, knockdown of 24 candidate genes in developing brains led to 11 hits with microcephaly phenotypes. Eight additional lines corresponding to six genes were selected for examination. Preliminary results of the eight lines screened indicate no significant brain size reduction. We will increase our sample size and screen additional lines. The results of this study and the research overall is increasingly pertinent as it can provide comfort to families and a diagnosis for patients with rare genetic disorders. Furthermore, our work can illuminate important pathways during brain development.

Poster 73

Presenter: Valerie Vaca (CSUN)
Mentor: Anna Gannet Hallar (Atmospheric Sciences)
Tracing 2020 Wildfires in Western U.S.

Climate change factors have caused fire occurrences to increase and studies indicate the pattern is expected to continue (Wilmot et al., 2021). In response to this, PhD student Kai Wilmot is working on a model to predict air quality from smoke events. In this presentation, we used aerosol light scattering data from Storm Peak Laboratory to conduct case studies

following the source of large fires. If accurate, these case studies could be utilized to provide a basis for Wilmot's model to test its efficacy. Improved understanding in the movement of smoke is crucial for the model's functionality. After obtaining a date of interest based on the aerosol scattering data, we used the Hysplit trajectory model to trace the fire source and MODIS fire detection to confirm the source of our fire.

Poster 74

Presenter: Manette Perez (Utah Valley University)
Mentor: Mary Nelson (Chemistry)
Can't We All Just Get Along? Putting BAF Complexes on Plasmids

DNA in mammalian cells is long and requires packing inside the nucleus. An opposite-charged relationship is formed around nucleosomes and folded into a chromosome. However, polymerases cannot attach to the DNA and start transcription because DNA's closed bond. Chromatin remodelers such as yeast's Switch/Sucrose Non-Fermenting complex (SWI/SNF) can separate or expel nucleosomes. The human version, the BAF complex, consists of 3 complexes, GBAF (GLTSCR1-BAF), CBAF (Canonical BAF), and PBAF (Polybromo BAF). The sub-units of these complexes, if mutated, are involved in various cancers. The focus of our research is the CBAF and GBAF's sub-unit SS18. If SS18 fuses with SSX by chromosomal translocation, synovial sarcoma occurs. The roles for each BAF complex are unclear, so we plan to put the subunits of CBAF and GBAF on plasmids in order express all sub-units and compare. In order to achieve this, we used biGBac cloning, which combines multiple genes in sub-plasmids. Each set of genes in sub-plasmids are then combined into a large plasmid consisting of sub-plasmid sequences onto a backbone. Individual genes/sub-unit (ex. BAF60) were amplified, purified, and cloned into an initial plasmid. We used correctly assembled clones and connected them with compatible sequences using Gibson. When all correct genes were connected, we transfected human cells and purified each BAF complex individually. Silver Stain and Western Blot were performed to quantify and confirm correct sub-unit expression. The results showed that certain sub-units were precisely expressed and purified, while others were not. We can confirm that one of the sub-units, BAF60, (found in both CBAF & GBAF) was able to bind the complex and immuno-precipitate. There are potential reasons why the complex could not keep its integrity, but in the future, we will re-check exactness of clones and determine if specific recombinant BAF complexes can be assembled.

Poster 75

Presenter: Isaac Warner (University of Utah)
Mentor: Kensaku Kawamoto (Biomedical Informatics)
Decision Precision+: Enabling Lung Cancer Screening Shared Decision Making integrated with the Electronic Health Record

Lung cancer is the leading cause of cancer deaths worldwide. Screening with a low dose chest CT could save more lives than breast cancer screening, however the current screening rates are at about 5%. An important barrier to improving these rates is the need for individualized shared decision making. A tool to help providers with this shared decision making process, Decision Precision has been developed by collaborators at the University of Michigan, available at ScreenLC.com. We extended this tool by using state-of-the-art prediction models from the National Cancer Institute, as well as integrating it with the Electronic Health Record (EHR). This tool, Decision Precision+, by integrating directly with tools that providers already use, will enable efficient shared decision making for a complex clinical decision in primary care. This has been identified as a key research need by the US Preventive Services Task Force. We have successfully integrated this tool with the EHR using the SMART on FHIR interoperability framework, deployed it into clinical care at University of Utah Health, and it will be disseminated nationwide across the customer base of Epic Systems, which manages the records of over half the US population. Decision Precision+ will be one of the first SMART on FHIR clinical applications to be widely distributed across the nation. Performance improvements have been made to the application which have decreased the load and rendering time to approximately 3 seconds, which represents about 100% improvement over the initial version. Interface errors have also been reduced, which have improved the overall user experience. These time-saving features are critical for providers, who have limited time during busy encounters. Other

improvements to the code base have been made, including reducing code duplication, allowing for a faster development cycle and application validation.

Poster 76

Presenter: Grace Liu (University of Utah)
Mentor: Ramkiran Gouripeddi (Biomedical Informatics)
Using NASA Satellite Data to Link Air Pollution and Health Outcomes

Air pollution has been linked to many adverse health outcomes from asthma to cardiometabolic disorders to dementia. The EPA has air pollution data for most metropolitan areas within the US. However, there are many populations in the US that do not have a monitor within range, especially in rural areas. NASA has instruments aboard their satellites that are circumnavigating the globe daily, capturing air pollution data for the entire US. We analyzed level 3 gridded NASA instrument data for the US from 2005-2019. CO, PM2.5, and SO2 were measured by MERRA-2 at a resolution of 0.5° by 0.625° (https://disc.gsfc.nasa.gov/datasets/M2T1NXAER_5.12.4/summary?keywords=merra%20pm2.5), and NO2 and O3 were measured by OMI at a resolution of 0.25° by 0.25° (https://disc.gsfc.nasa.gov/datasets/OMI_MINDS_NO2d_1/summary?keywords=omi). We used Python to find descriptive statistics for the five pollutants and explore large row anomalies in NO2 and O3, the pollutants measured by OMI, by year and region. Descriptive statistics indicate how the data changes and what it looks like by revealing temporal and spatial patterns. For example, NO2 levels have steadily decreased 30-40% in the last decade due to environmental regulations. Considering missing values, filler values, outliers, and reasons for them also gives a better understanding of the satellite instruments compared to other methods of measurement. By using data from satellite instruments, we can determine whether relative changes in air pollution have the same effect in areas that lack ground-based monitors, helping to bring environmental equality to epidemiological research. With clean data, we can accurately correlate satellite events with aggregate clinical events. In the future, we can correlate the data and outliers with meteorological factors, EPA monitor data, and other sources like PurpleAir monitors.

Poster 77

Presenter: Matthew Laskowski (University of Maryland-College Park)
Mentor: Ryan Steele (Chemistry)
Deciphering the Vibrational Spectrum of Protonated Glycine Hydrates

Vibrational spectra provide insight into the molecular structure, electronic structure, and inter and intramolecular interactions of chemical systems. Experimental predissociation action spectra for protonated glycine and its hydrates have been obtained by Garand[1] Although previous harmonic spectra appear to have assigned the monohydrate spectrum to two low energy conformers, considerable explained spectral structure was observed in the hydrogen-bonded amine stretch region, and this structure is entirely absent in harmonic computations. Anharmonicity and the coupling of vibrational modes were hypothesized to be responsible for this behavior. Here, w*e* report a new computational analysis of the vibrational spectrum of the monohydrate. Anharmonic simulation methods, combined with accurate *ab initio* potential energy surfaces, *w*ere used to investigate the source of these spectral anomalies. Results to-date have suggested that the two-isomer assignment is perhaps incorrect and that converged calculations show only a single unique structure along rotation of the protonated amine. Multiple nearly degenerate D_2 tagging sites have been discovered, which account for anomalous spectral peaks. Anharmonic simulations are ongoing and will be used to decipher the role of resonant vibrational interactions in this unique vibrational profile.

Poster 78

Presenter: Autumn Tsosie (University of Northern Colorado)
Mentor: Lilliam Pinzon (Dentistry)
Bond Strength of Self-Adhesive Resin Cement to Sound and Caries-Affected Dentin and Enamel

The purpose of this study is to determine the bond strength of self-adhesive (SA) resin cements versus a conventional cement. Dental cement is indicated in dentistry for several procedures such as direct restorations, indirect restorations, and endodontic procedures. In this study, 40 human sound and 40 human caries-affected permanent molars were randomly selected and sectioned into halves (n=160). The sound and caries specimens were randomly distributed into twenty groups (n=8) and treated with the following cements: (1) Dual-cured EsteCem II (conventional), (2) G-CEM ONE (SA), (3) Panavia (SA). The cement stubs were bonded at the tooth substrate (dentin or enamel) in a shape of a cylinder (diameter 1 mm, height 3 mm). All the cements were bonded with and without the adhesive agent recommended by their respective manufacture except for the conventional which always requires the adhesive agent. Specimens were stored in water at 37°C for 24 hours. The specimens were de-bonded in tension with a universal testing machine at a crosshead speed of 1.0 mm/min. Bond strength values were calculated. Failure modes were determined at 100X magnification. Means and standard deviations were calculated. Means were compared using analysis of variance. Fisher's PLSD intervals were calculated at the 0.05 level of significance. For this study, we expect no significant differences between conventional and SA cements. If both resin cement types show equal bond strength values, the SA cement would be a cost-effective approach (less clinical time, less steps, less tools, less visits, etc.) for several dental procedures.

Poster 79

Presenter: Tessa McNamee (University of Utah)
Mentor: Shanti Deemyad (Physics & Astronomy)
Properties of Superconductivity in BaSbTeS2 using X-Ray Diffraction and Raman Spectroscopy

We present studies of charge density wave (CDW) behavior as it relates to superconductivity in BaSbTeS2. The relationship of CDW materials and superconductivity is an important topic in condensed-matter. X-Ray Diffraction (XRD) is used to identify crystalline structures of materials, and can detect signatures of CDW. Further, Raman spectroscopy is paired with XRD and resistance measurements to better understand superconductivity. Pressure can tune both electronic properties and crystal structures, such as in the sample BaSbTeS2, which displays interesting behavior of CDW materials at ambient pressure. By application of high pressure, we suppressed the CDW in BaSbTeS2 and detected the emergence of superconductivity.

Poster 80

Presenter: Jess Ubbelohde (Truman State University)
Mentor: Jon Rainier (Chemistry)
Synthesis of Pentacyclic Oxazole Derivative for Photochemical Probing

In this work we examine how a chiral center that is present in the starting material affects the torque selectivity (a branch of stereochemistry) of a photoelectrocyclization reaction of a conjugated cyclohexenone-phenyl-oxazole system. This reaction results in the generation of a multicyclic system and will ultimately be employed in the synthesis of complex and biologically active natural products. In general, photoelectrocyclization reactions comprise a family of ring closing transformations wherein one pi bond is converted into a sigma bond (or vice versa). Although our particular reaction only proceeds after the absorption of a photon, photoelectrocyclization reactions can generally be run using either light or heat to initiate a reaction without the use of additional reagents. This property makes them efficient. This poster will describe the synthesis of the starting material from cross-coupling reactions and our investigation of the photoelectrocyclization reaction itself.

Poster 81

Presenter: Jens Nilson (University of Utah)
Mentor: Russell Richardson (Internal Medicine)
Mitochondrial Respiration in Skeletal Muscle: The Effect of Oxygen Availability

Mitochondria perform many important processes in the body, the most well know of which is acting as the "powerhouse" of the cell". The energy produced by mitochondria help fuel essential functions of the body, and more fully understanding how these special organelles function and react to disease, aging and environmental changes will contribute to a more complete understanding of human exercise capacity and, ultimately, overall health.

This research focuses on mitochondrial respiration and the capacity of mitochondria to respire in differing levels of oxygen. Mitochondria were collected in the form of a muscle biopsy from the right vastus lateralis in human subjects. Muscle samples were prepared for experimentation using two methods, yielding isolated mitochondrial samples, as well as permeabilized tissue samples. Samples were introduced to 2 mL respirometry chambers containing either normal or high levels of O_2. Excess concentrations of glutamate, malate, succinate, and ADP were then introduced to the chamber to induce CI+CII state 3 (maximal) respiration, and measurements were made of PO_2, O_2 consumption, and H_2O_2 production using high resolution respirometry (Ouroboros O_2k).

Results are preliminary, pending further subject participation, but even these preliminary analyses yield interesting findings. Specifically, maximal respiration was similar in both high and normal PO_2 environments for both isolated and permeabilized samples. The PO_2 critical point, or the level of PO_2 at which respiration is compromised, in isolated mitochondria, was not altered by initial PO_2. However, in contrast, the PO_2 critical point for mitochondria assessed in permeabilized fibers was affected by initial PO_2. In permeabilized fibers, mitochondria in the high oxygen conditions exhibited higher PO_2 critical points. Furthermore, PO_2 levels, while not affecting maximal respiration, seem to have a negative effect on overall respiration of the mitochondria assessed in permeabilized fibers.

It is expected that this research will provide valuable insight into the link between oxygen availability and mitochondrial function. This will lead, ultimately, to a better understanding of the link between mitochondrial dysfunction, disease states, and aging.

Poster 82

Presenter: Derek Lawrence (University of Utah)
Mentor: Jill Shea (Surgery)

Porous Fluorapatite Scaffolding With Adipose Derived Stem Cells Bone Graft

The annual frequency of approximately 6.3 million fractures demonstrates that bone injuries in the United States are of high medical interest. Often fracture injuries are treatable through non-invasive means. However, sometimes these injuries result in critical-size defects- defined as the size of an osseous defect that does not heal spontaneously with bone during the lifetime-which needs surgical interventions with replacement scaffolds. There are three types of scaffolds currently used in medicine: autografts, allografts, and engineered bone grafts. Although autografts are ideal, they are in short supply and need a second surgical site. Allografts fail in larger defects, partially because they do not contain the same cells as an autograft. Thus, a need to develop ideal engineered bone grafts arises. Ideal engineered bone grafts are not only made to provide strength but also to serve as base structures for bone regrowth and have the ability to bio-resorb. In this study, we fabricated hydroxyapatite and fluoridated apatite-based scaffolds (FA), combined them with a patient's own stromal vascular fraction (SVF) cells, a heterogenous mixture of cells within adipose tissue where usable undifferentiated stem cells are, and tested the ability of the surfaces to regenerate bone tissues. The rationale for this study was to engineer the scaffolds to have similar regenerative properties as autografts with the addition of stem cells, the hypothesized end result being a significant and observable difference in regrowth of injured bone between scaffolds, with the FA scaffold/SVF cell combo performing the best. This concept was tested in a rat femoral defect model with defect left untreated, treated with autograft, FA scaffold, or the FA scaffold/SVF cell combo (n=6/group). The rats were monitored using micro-CT at two-week intervals, and percentages of new bone formed with the defect were calculated. The data so far has shown that SVF cell extractions from both rat and human samples are adhering to the FA scaffolds uniformly, differentiating well, and are medically promising.

Poster 83

Presenter: Re Perry (New York University)
Mentor: Corrine Welt (Human Genetics)
Premature Follicle Loss Caused by Mutation in eIF4ENIF1

Whole exome sequencing of a large family with a history of primary ovarian insufficiency [characterized by early follicle depletion] demonstrated a heterozygous nonsense mutation in the gene, eukaryotic translation initiation factor nuclear import factor 1 (eIF4ENIF1). We hypothesized that like the human, a heterozygous mouse model will have POI, the mechanism for POI will be follicle loss that can be detected at the point where oocyte growth begins, and that follicle loss is occurring via apoptosis. We made a Eif4enif1C57/Bl6 transgenic mouse model containing a floxed exon 10-19 cassette and a conditional knock-in cassette containing exon 10 with the stop-gain mutation causing familial POI and WT exons 11-19. Genotype analyses of DNA extracted from ear or tail biopsies were performed by PCR and Sanger sequencing. Ovaries were collected from mice age days 5-10. Tissues were stored in 70% ethanol, fixed in paraformaldehyde, embedded in paraffin, sectioned to a thickness of 6 μm, and affixed on glass slides. Oven-dried sections were deparaffinized in xylene and rehydrated by a graded ethanol series. Primary and preantral follicles were counted in the fixed ovaries. Data were analyzed using two-way analysis of variance (ANOVA) with post hoc testing. A TUNEL assay was performed to qualitatively account for apoptosis. We found no significant difference in follicle count until day 7, where the heterozygous ovaries demonstrated significantly more cells lost relative to the wildtype. Therefore, follicle death begins between days 5 and 7. Polysome profiling will be used to understand the mechanism initiating cell loss in individuals with POI.

Poster 84

Presenter: Kamiya Watkins (Spelman College)
Mentor: Denise Allard Trout (Pathology)
Development of a Model for Tissue-Specific, Inducible, Titratable Antigen Expression to Study T Cell Responses

A hallmark of memory formation is the ability to prime T cells to respond more robustly to future antigen exposure. However, autoimmune T cell memory development and persistence mechanisms are poorly understood because systems, where self-antigen expression can be regulated, are lacking. Many have used membrane-bound ovalbumin (OVA) driven by the insulin promoter as a model for autoimmune diabetes. However, in this system, you cannot control when OVA is turned on. We created a model where we can turn on and off the expression of OVA by crossing mice bearing transgenic membrane-bound OVA under the control of the rtTA-doxycycline (DOX) promoter; a tetracycline-inducible transcriptional activator protein used to control gene expression in mammalian cells, to insulin-cre mice. To validate our inducible model, we used an in vitro proliferation assay. We MACS enriched CD4+ OTII cells and stained them with carboxyfluorescein succinimidyl ester (CFSE), which allows tracking cell division and stimulated them with dye before plating anti-CD3 and anti-28, CD11c-cre driven OVA, or insulin-1-cre driven OVA. We observed proliferation in CD4+ OTII cells stimulated with anti-CD3 and anti-CD28 and CD4+ OTII cells co-cultured with either DOX-treated CD11c+ cells isolated from CD11c-Cre rtTA-OVA mice or Dox-treated islet cells isolated from Ins1-Cre rtTA-OVA mice. These findings revealed that treatment of CD11c+ cells isolated from CD11c-Cre rtTA-OVA mice and DOX-treated islet cells isolated from Ins1-Cre rtTA-OVA mice with DOX promoted successfully induced OVA expression. A low level of proliferation was also observed in CD4 OTII cells co-cultured with CD11c+ cells isolated from CD11c-Cre rtTA-OVA mice in the absence of DOX indicated low-level baseline DOX expression. Our data describe a novel model to study tissue antigen-specific T cell responses and T cell memory formation in which antigen expression can be manipulated by DOX treatment.

Poster 85

Presenter: John Kaman (Iowa State University)
Mentor: York Smith (Materials Science and Engineering)
Reduction of Lithium-ion Battery Materials By Hydrogen for Recycling

The mining of materials used in lithium-ion batteries (LIBs), particularly cobalt, is not sustainable and presents environmental and humanitarian problems. Current recycling methods for LIBs are costly and energy-intensive, partially due to the step in which the metal oxides in the cathode are reduced to recoverable forms. A thermal treatment of LIB materials using hydrogen as a reduction agent has shown promise as an economical and environmentally-friendly alternative. This project investigates the reduction reaction of NMC (Lithium Nickel-Manganese-Cobalt Oxide), an LIB cathode material, via hydrogen. It was found that it goes through a multi-step reaction and has a lower activation energy than reduction via carbon. Although this can contribute to a more efficient method of recycling LIBs, further study of the reaction kinetics and pathways is necessary as well as incorporation into a complete recycling process.

Poster 86

Presenter: Jordan Muehlberger (Dixie State University)
Mentor: Djin L. Tay (Nursing)

Adaptation of an Observational Rating System for Collaborative Communication Between Patients and Caregivers for Shared Advance Care Planning Decisions

Introduction: Effective communication and decision making can become difficult in stressful situations. The end of life is highly stressful that may require surrogate decision making by caregivers. Yet caregivers are under involved in advance care planning (ACP) with patients for future end of life decisions. Collaborative decision making between chronically ill patients and their caregivers could facilitate shared decision making.

Background: Communication quality between patients and caregivers can affect shared decision-making during ACP, which can be affected by emotional and relational influences. While collaborative communication can facilitate effective shared decision making, few rating systems exist to evaluate the quality of patient-caregiver collaborative communication for shared ACP decisions.

Purpose: The purpose of this study is to evaluate the applicability of the adapted Naïve Observational Rating System (NORS) for collaborative communication coding in shared patient-caregiver ACP.

Methods/Materials: Chronically ill patients (age 55+) and their chosen caregivers (age 18+) were recruited from a home health agency in Utah. Patient and caregiver dyads participated in a (10-41 minutes) video recording of a collaboration-focused shared ACP decision making conversation as part of a larger intervention study. Recordings were transcribed verbatim and two researchers coded verbal and non-verbal communication using an adapted version of the Naïve Observational Rating System (NORS)

Results: Eighteen patient-caregiver dyads were purposively recruited. The majority of participants were female (13 caregivers; 11 patients). The mean age for caregivers was 61.28 (SD= 13.60) and patients were 68.22 (SD=9.64). Two researchers coded using an adapted version of the NORS on a 10-point Likert Scale (1-10) using the following items: constructiveness, negative reciprocity, positive reciprocity, patient demand/caregiver withdrawal, caregiver demand/patient withdrawal, mutual avoidance, vulnerability/empathy-support, mutual acceptability of problem, naturalness, simplicity/complexity, persuasion, and power/influence. A consensus was reached between researchers on the definitions of the rating categories. The top three highest collaboration patterns were vulnerability/empathy-support (M=7.61, SD=2.23), constructiveness (M=7.33, SD=2.00), and simplicity/complexity (M=6.50, SD=2.18). The collaborations that were rated the lowest were negative reciprocity (M=1.44, SD=0.86), patient demand/caregiver withdraw (M=1.50, SD=0.92), and caregiver demand/patient withdraw (M=1.72, SD=1.02). Constructiveness was positively correlated with negative reciprocity (r=0.53, p=0.02) and mutual acceptability of the problem (r=0.53, p=0.02); and negatively correlated with caregiver demand/patient withdraw (r=-0.54, p=0.02) and mutual avoidance r=-0.52, p=0.02). Positive reciprocity was negatively associated with patient demand/caregiver withdraw (r=-0.58, p=0.01) and associated with caregiver persuasion (r=0.53, p=0.02).

Conclusion: No observational rating system exists for the study of collaborative communication between patients and caregivers during shared ACP decisions. This study demonstrated the applicability of an adapted version of the NORS for collaborative ACP decision making. Future steps would include triangulation of qualitative analysis to contextualize quantitative ratings.

Poster 87

Presenter: Derek Anderson (University of Utah)
Mentor: Samantha Steyl (Bioengineering)
Surface Morphology of Zinc-doped Fluorapatite and its Effect on Biofilm Formation

As part of the ongoing effort to develop an acceptable synthetic bone substitute, Zinc-doped fluorapatite (FA) was synthesized with molar concentrations ranging form 0-2% Zn. Zinc nano-particles have been noted to have antimicrobial properties and could help to prevent infection and biofilm formation in healing wounds. This is of particular importance in circumstances where the bone tissue is exposed to external contaminants, such as in dental extractions and open fractures, as the rate of wound healing is dependent of the The doped FA was then pressed into discs with varying pressures and sintered at varying temperatures, resulting in varying surface morphology of the discs. This surface morphology was imaged under SEM and its effect was observed in a CDC biofilm reactor. Despite the time limitations of this study, discs pressed at higher pressures were clearly observed to decrease the formation of a biofilm on the surface of the FA disc, across all temperatures, and compositions. No clear data was obtained on the effect of the Zinc in the FA discs, or the sintering temperature.

Poster 88

Presenter: Revi Brown (Wesleyan University)
Mentor: J. David Symons (Nutrition and Integrative Physiology)
Inhibiting Autophagy in Human Brain Microvascular Endothelial Cells Increases Blood Brain Barrier Permeability

Vascular cognitive impairment (VCI) places a tremendous burden on patients and society. The precise mechanisms leading to VCI are unclear. Alterations in the blood brain barrier (BBB) have been proposed to contribute to VCI. The BBB provides a barrier between the brain and the blood protecting neurons from potential damage. It is known that age-associated deterioration of the BBB occurs, but what is the mechanism? Autophagy is an intracellular protein degradation pathway. We have shown that repressed endothelial cell (EC) autophagy contributes to BBB defects. Further, adult mice with genetic repression of EC autophagy display increased BBB permeability assessed in vivo. We sought to substantiate the latter finding using a reductionist approach. Here we test the hypothesis that human brain microvascular ECs (HBMVECs) with repressed autophagy display increased EC permeability in vitro. HBMECs were seeded on a 96 well Electric Cell-substrate Impedance Sensing (ECIS) plate. HBMVECs were monitored for ~20h until a stable monolayer of ECs formed. Following evidence for a stable monolayer, HBMVECs were treated with a vehicle (PBS, negative control), interleukin 1 beta (IL-1β, positive control), or 3-Methyladenine (3-MA, inhibitor of autophagy initiation). Permeability was assessed from 22-40h at 5-min intervals, in 16-wells of a 96-well plate per treatment. IL-1β confirmed our ability to detect changes in permeability, heightening permeability vs PBS. Increased permeability was observed in HBMVECs with 3-MA vs PBS. This indicates that impaired endothelial autophagy contributes to increased BBB permeability, providing proof of concept that repressed autophagy might contribute to VCI. To complement this pharmacological approach, ongoing studies will assess permeability across: (i) HBMVECs with genetic disruption of EC autophagy; (ii) primary ECs from mice with EC-selective depletion of autophagy-related genes; and (iii) primary ECs from older mice. The overall goal of this research is to determine whether EC autophagy may represent a therapeutic target for treating VCI.

Poster 89

Presenter: Luke Rosamond (University of North Carolina at Charlotte)
Mentor: Tim Garrett (Atmospheric Sciences)
Understanding the Effects of Turbulence on Falling Snowflakes

Energy from turbulence in the surface layer can cause snowflakes to rotate, and finding a way to quantify how much energy could be important in understanding the life cycle of a snowflake. There is still much that is unknown about how snowflakes form and fall, and there is a particular lack of information about how turbulence affects the angular motion of a snowflake. The goal of this project was to track falling snowflakes using video imagery captured with the Snow Pixel instrument at Alta Ski Area, extract information on their rotation from the imagery data, and use that information to calculate the energy contributed by turbulence to the rotation of the snowflakes. The first attempt at analyzing the video imagery employed the regionprops toolbox in MATLAB. This was an issue, however, because there was no good way to properly track the snowflakes using just this toolbox. The vision toolbox gives access to machine learning algorithms for tracking moving objects, so a Kalman filter was used to track the snowflakes so that their properties could be analyzed.

Poster 90

Presenter: Sahar Kanishka (University of Utah)
Mentor: James Gagnon (School of Biological Sciences)
Lineage Tracing in Zebrafish with CRISPR Prime Editing

All embryos develop from a single cell. We use lineage tracing to map the relationships between individual cells and back to the initial founding cell. These lineage trees can help us understand how cells acquire their fates during normal development, and how that can go wrong in human disease. An emerging method for lineage tracing in embryos uses cellular barcodes. Cellular barcodes individually tag cells with a unique set of mutations specific to that cell. As cell divisions occur, the barcode is passed on to the progeny cells and a lineage tree can constructed based on cells that share similar barcodes. The CRISPR-Cas9 system for gene editing is an ideal tool for creating a huge diversity of cellular barcodes in embryos. However there are limitations with CRISPR-Cas9, including unpredictable indel formation and difficulties in recovering barcodes from cells. In this project, a modified CRISPR system known as prime editing will be applied in zebrafish, and utilized for lineage tracing. Prime editing allows for precise genome editing by inserting user-specified genetic sequences at a target site in the genome. I hypothesize that we can use prime editing to insert a huge library of user-specified barcodes into the genome of developing zebrafish. Because these barcodes are defined by the experimenter, they can be recovered at the end of the experiment using RNA in situ hybridization. In principle, lineage tracing with prime editing will allow us to discover the spatial arrangement of related cells in intact embryos and tissues. We hope to use lineage tracing with prime editing to understand the mechanisms of heart regeneration in zebrafish.

Poster 91

Presenter: Tako Tako (University of Utah)
Mentor: Elijah Bring Horvath (Medicinal Chemistry)
Mechanisms of Antibiotic Resistance and Natural Product Antibiotic Discovery

Bacteria are the cause of over 27% of all illnesses in the world. There are a multitude of ways to fight against them currently, but this is an uphill battle. There are antibiotic-resistance (AR) genes in bacteria that can protect against other bacteria but are also used to gain resistance against medicines clinically used1. Multi-drug resistant (MDR) bacteria are the most dangerous as they are resistant to multiple classes of antibiotics2. Natural products (NP)s are chemical compounds or substances produced by living organisms. To find a way to combat MDR strains of bacteria, researchers have continued to explore NPs as sources of new antibiotic compounds capable of eliminating these pathogens3. A rare class of NP antibiotics are enediynes. Enediynes are unique compound, characterized by a 9- or 10- member core made of two alkyne groups conjugated to a carbon-carbon double bond4,5. These compounds exhibit potent bactericidal properties that make them a strong candidate to combat MDR strains of bacteria. Using genomics, we have previously identified four putative enediyne-producing microbes isolated from the Great Salt Lake (GSL) by the Winter lab. By exploring the antibiotic-producing potential of bacteria found in the unique GSL environment and using MDR strains of clinical pathogens as screening tools, we are working to isolate novel enediyne compounds and test them against different MDR strains of bacteria to develop them as antibiotics.

Poster 92

Presenter: Mary Schaelling (University of Utah)
Mentor: Mahesh Chandrasekharan (Radiation Oncology)
The Path Maker to Life or Death

Ubiquitin is a protein that regulates the activity of other proteins done through the process called Ubiquitination which is involved in most cell processes such as DNA repair and protein degradation. This occurs when a covalent conjugation of ubiquitin to the amino acid group lysine of a substrate protein occurs. A three step pathway consisting of the enzyme E1 which is powered by ATP hydrolysis, E2 a conjugating enzyme and the third E3 Ligase.

The same enzyme can create an assortment of ubiquitinated protein topologies: multi-,mono-, or polyubiquitinated proteins that affect the fate of the modified protein. Mono Ubiquitination is responsible for chromatin regulation and protein sorting. Poly ubiquitination with a chain of ubiquitin is responsible for signaling and autophagic degradation. An underlying problem found in human diseases such as Cancer, Parkinson's and Alzheimer's is misregulation of proteins or when protein degradation does not occur. Specifically looking at the E2 enzyme known to contribute to ubiquitin chain assemblies we can better understand contributors to these diseases. Examining ubiquitination in vitro is time consuming. By reconstituting the 'UbiGate' system in E. Coli by Kowarschik originally shown in plant cells. Allows ubiquitination cascades using 'Golden Gate' Cloning be done in a timely manner. The ubiquitination system will contain Rad 6, Bre1, Lge1 the system where Rad6 is a conjugating enzyme in E2, Bre1 is a conjugating enzyme in E3 and Lge1 is a support factor. To look into what may cause the signal for mono or polyubiquitination to occur in E. Coli.

Our ubiquitination system showed that the different combinations of Rad6, Bre1, Leg1 successfully cloned and expressed in E. Coli. Next step is to transfer this system into human cells where we can study other parts of the Ubiquitination cascade and the effects different conjugating enzymes may have.

Poster 93

Presenter: Nereyda Martinez (University of Utah)
Mentor: Ellen Leffler (Human Genetics)
Evaluating P. falciparum gene essentiality using loss-of-function intolerance

Plasmodium falciparum is the most common cause of human malaria and carries the highest mortality rate across all *Plasmodium* species. Given the rapid development of drug resistance to most available antimalarial drugs and the complex biology of *P. falciparum*, the determination of essential genes is crucial to identify potential drug targets and increase understanding of *P. falciparum* gene function. A high-throughput mutagenesis screen identified 2,680 genes as essential in the asexual blood stage (Zhang et al. 2018). However, there are two other lifecycle stages of the malaria parasite and environmental factors that aren't reflected in this screen, warranting additional work to further identify essential genes. A complementary method to defining gene essentiality is utilizing large datasets of genetic variation to determine loss of function (LoF) variants in genes and intolerance to inactivation. Here we use the Pf6 dataset of 7,000 *P. falciparum* genomes to analyze deleterious variants predicted to cause loss of function such as frameshift and stop-gain variants. We identify genes where LoF variants are not observed and compare with the blood-stage estimates of essentiality. We expect to find LoF-intolerant genes are enriched for blood-stage essentiality and identify new essential gene candidates.

Poster 94

Presenter: Adamaris Martinez (University of Utah)
Mentor: Anne Kirchhoff (Oncological Sciences)
Identifying and Testing Strategies of Communicating Research Results to Participants

Purpose: Disseminating results to participants is a missing practice in many research studies. There are few resources that exist on how to return research results to participants. We evaluated participant and advisory board member opinions about a newly created infographic that shared findings from a study on HPV vaccination among cancer survivors.
Methods: A literature search was conducted through Google Scholar and PubMed on returning research results back to study participants. We created a checklist on strategies for returning research results to participants. We then designed an infographic on the HPV study results and emailed the infographic, the published journal article, and a survey to the participants and advisory board members for feedback. Percentages were calculated to summarize survey content.
Results: The literature search found that participants: (1) preferred to receive study results via email, (2) had a positive reaction to the results, (3) wanted results disclosed in lay terms, (4) wanted other materials included like the published journal article. A six-step checklist was created and will be used at the conclusion of future research studies. An infographic was created for the HPV vaccine study (to date 6 out of 31 have taken the survey). Of the participants so far, 90% indicated the infographic was easy to understand and 50% planned on sharing the infographic with family, friends, and a cancer survivor Facebook group.
Conclusions: Research studies should make efforts to share their findings with participants through email and using language that participants will understand. While our data collection is ongoing, participants from our HPV vaccine study seem to appreciate receiving study results and plan on sharing the findings with others. Participants indicated they joined the HOP study to contribute to science, gain knowledge, having health concerns as a cancer survivor, and concerns for family members.

Poster 95

Presenter: Gary Urry (University of Utah)
Mentor: KC Brennan (Neurology)
Studying the effects of altitude on migraine.

Migraine affects a large portion of the global population. People living at moderate and high altitude (~3,000 ft to >8,000 ft) are more likely to suffer from migraine compared to low altitude. In a large portion of migraine patients, migraine is preceded by a defined physical event or 'aura' called Spreading Depolarization (SD). In our research we will employ mouse models, and we will use SD as a physical marker of migraine. SD is also more common in mid-to-high altitude patients. While we have data that says people are more likely to experience migraine and SD at mid-to-high altitude, we still do not understand why and how this happens. Our aim is to try and understand the cause of this higher frequency of migraine and SD as it relates to altitude. This summer we specifically focused on determining if and how changes in the blood due to altitude will affect SD. Red blood cell expansion occurs at mid-to-high altitudes and leads to increased blood hematocrit, viscosity, and thrombosis risk. This may be a pathway that leads to higher risk of migraine, as increased thrombosis may lead to SD. To study this we built low-cost homemade altitude chambers to acclimatize groups of test mice for 10 days at: Sea Level (0 ft); Mid Altitude (SLC altitude) (~4500 ft); and High Altitude (~15,000 ft). (one group per). After 10 days in these chambers, we took the mice out and measured their hematocrit to ensure we prompted the desired blood changes. We will measure their SD threshold as we progress into the next phase. After our first experiments we were able to see physiological changes from our simulated altitude, leading to an average ~25% difference in hematocrit percentage in our High-Altitude group vs. our Sea Level group. Our hematocrit changes show good promise that we will have the physiological changes needed for our other experiments. Our future experiments will focus on continuing our investigation using these same methods to which we will add SD threshold experiments and measurements of total plasma volume.

Poster 96

Presenter: Luis Torres (University of Texas at El Paso)
Mentor: Jeanine Stefanucci (Psychology)
The Influence of Feedback on Stepping Out Gap Judgments in Virtual Reality

The Influence of Feedback on Stepping Out Gap Judgments in Virtual Reality

Accurate affordance gap judgments are critical in our everyday lives. There is currently no easy way to train affordance gap judgments, particularly for high-risk situations such as outdoor and rescue activities. Virtual reality (VR) environments offer potential for affordance training. However, we do not know if virtual reality training of gaps will affect behavior in the real world. Addressing these matters requires testing affordance training in stepping out gap judgments in both the real world and VR. Here, we examined one affordance judgment in both environments - stepping over a gap. We first measured participants' estimation of their biggest step in the real world. Participants then completed segments of training in VR that included adjustment and feedback phases. In adjustment trials, participants adjusted a virtual template with a footprint to a distance where they perceived their biggest step could be taken. In feedback trials, the template was farther or closer than their baseline step, and participants had to decide if they could take the step. Following this affordance judgment, they then took the step to receive visual feedback on where their foot landed. Our goal was to determine if outcome feedback about stepping out judgments in VR improves real world and VR affordance judgments. Real world performance variability decreased following the training regimen. Post-test normalized standard deviation was 0.12 whereas pre-test standard deviation was 0.14. While preliminary data show a high degree of variability, results indicate that training in VR does have an influence over affordance gap judgments when stepping out. Keywords: affordance, virtual reality, gap, stepping out, perception, behavioral training

Poster 97

Presenter: Henry Ponce-Orellana (University of Utah)
Mentor: Aaron Puri (Chemistry)
Methane-Oxidizing Bacterial Communities: An Understudied Source of Antibiotics

The field of natural products encompasses the discovery of novel molecules created by microorganisms, plants, and animals. These compounds often have very potent bioactivities and form the basis of many compounds essential to medicine and agriculture because they are produced by, and interact with, biological systems. There is, therefore, a constant demand for novel natural products. Methane oxidizing bacterial communities are a promising source of undiscovered natural products due to them being historically understudied. *Chryseobacterium* sp. 52 is a member of these understudied bacterial communities which was isolated from Lake Washington, Seattle. *Chryeobacterium* sp. 52 produces an unknown antimicrobial compound that inhibits the growth of *Bacillus subtilis*, which has not been reported in literature. Currently we're in the process of scaling up production of *Chryseobacterium* sp. 52 in order to isolate, purify, and characterize the compound of interest.

Poster 98

Presenter: Jose Herrera (University of Utah)
Mentor: Tony Reyes (Oncological Sciences)
KRT13+ cells represent a novel state in lung squamous cell carcinoma

Non-small-cell lung cancer (NSCLC) makes up about 85% of all lung cancer cases in the US and is primarily comprised of two major subtypes: lung adenocarcinoma (LADC) and lung squamous cell carcinoma (LSCC) (1). These two major subtypes can be distinguished by their expression of key markers and their histology (1). The canonical markers used to distinguish LSCC from LADC are expression of Keratin 5 (KRT5) and delta p63 (DNP63). Expression of these markers are observed in squamous tumors from multiple genetically-engineered mouse models of LSCC (*Sox2*$^{LSL/LSL}$*; Nkx2-1*$^{fl/fl}$*;Lkb1*$^{fl/fl}$ (SNL), *Sox2*$^{LSL/LSL}$*; Lkb1*$^{fl/fl}$ (SL)) (Figure 2A, C) (1). Genetically engineered mouse models have been useful tools to understand the impact of tumor heterogeneity on tumor progression.

Preliminary data from the Oliver lab show the presence of Keratin 13 (KRT13)+ cells within tumors from SNL mice infected with either CMV-Cre, which targets all cells, or CCSP-Cre, which is club cell specific, by single cell sequencing (scRNA-seq) (Figure 1A,B). Krt13 has been shown to mark a putative new cell type in the lung that acts as an intermediate state between basal cells and club cells during normal lung development and lung repair. (Figure 1C)(2). These KRT13+ lung cells expressed markers of cellular adhesion, squamous epithelial differentiation, and immunomodulation (2). The

presence of KRT13+ cells in SNL mice could represent a novel cell state in squamous tumors that could be contributing to intra-tumor heterogeneity and responses to therapy. KRT13+ tumor cells have been seen in other cancer types but their importance in LSCC is not known (3). **We hypothesize that KRT13+ cells represent a distinct cell state within squamous tumors that derive from KRT5+/DNP63+ cells and participate in immunomodulation of the tumor immune microenvironment.**

Poster 99

Presenter: Lethan Hampton (Howard University)
Mentor: Lisa Gibbs (Pathology)
Identifying Antigens Capable of Metabolic Reprogramming in the Myeloid Lineage of Stem Cells with a Focus on Atherosclerosis

Schistosomiasis is a prominent parasitic infection endemic to over 70 countries. *Schistosoma mansoni*, which is a species of intestinal schistosomiasis, mainly presides in Sub-Saharan Africa, South America, and the Caribbean, all areas where atherosclerosis, a disease of the arteries, and incidence of diabetes, is low. It has been published that mice infected with Schistosomiasis are protected from obesity and diabetes when on a high fat diet. By discovering the antigen credited with preventing heart disease, obesity, and diabetes through metabolic reprograming of myeloid progenitors, drug treatment or preventative therapeutics can be offered. To answer this question, several in vitro procedures working with stem cells of the bone marrow were performed, such as cell cultures and qPCR. Through enhancing differentiation from hematopoietic stem cells (HSCs) into myeloid progenitors into macrophages in the presence and absence of Schistosome soluble egg antigen (SEA), altered growth and metabolism has been observed between two groups, showing that metabolic reprogramming happens as early as the HSC level in the myeloid lineage of stem cells. Following this, SEA will be fractioned to determine which proteins are responsible for this metabolic reprogramming. Next, these fractions will be injected into mice to see if they mimic the protective effects of Schistosome infection on obesity and diabetes in vivo. Upon validation, recombinant proteins will be used to observe their functions individually. With this information, drug treatment or supplements using these identified proteins can be made to treat or prevent atherosclerosis.

Poster 100

Presenter: Sumeya Abdalla (University of Utah)
Mentor: Dilru Silva (School of Biological Sciences)
Prevention of RB Phosphorylation at Ser249 Regulates Autophagy

Pancreatic cancer is the third leading cause of cancer-related deaths in the United States with a 5-year survival rate of 10%. The most common type of pancreatic cancer is known as Pancreatic Ductal Adenocarcinoma (PDA) which is a disease of the cells lining the ducts that carry digestive enzymes. As of 2021, there has been an estimation that 60,430 Americans will be diagnosed with pancreatic cancer and there will be more than 44,220 deaths. This research focuses on a specific signaling pathway of proteins known as the Mitogen Activated Protein Kinase (MAPK) which promotes growth and is important in the formation of pancreatic cancer. The RAS>RAF>MEK>ERK pathway initially activates Cyclin-D which then activates the CDK4/6 protein to control the cell cycle. In the G1 phase of the cell cycle, CDK4/6 drives cell proliferation by inactivating RB, a tumor suppressor. CDK4/6 phosphorylates RB at 14 different sites in the G1 phase of the cycle. When CDK4/6 is inhibited with palbociclib, in addition to decreasing RB phosphorylation, the PDA cells increase autophagy. When PDA cells are treated with palbociclib and chloroquine, an autophagy inhibitor, it has an anti-tumor effect. In addition, when RB is knocked out from the cells and treated with a CDK4/6 inhibitor, there is a decrease in autophagy. Therefore, RB is required for palbociclib induced autophagy. The purpose of this project is to determine whether RB phosphorylation at a single site of the RB protein changes autophagy when treated with palbociclib. The lab previously generated RB KO cells via CRISPR-Cas9 to express RB mutants at a single phosphorylation site. Furthermore, we evaluated whether these mutants could alter autophagy. To conclude, we have found that mutant, S249, could potentially be a site that alters autophagy and the site S230 does not.

POSTER SESSION II

10:30 AM – 12:00 PM

Poster 1

Presenter: Kaitlyn Mostoller (University of Washington)
Mentor: Randy Jensen (Neurosurgery)
Microbubble-Aided Focused Ultrasound Non-Thermal Ablation in a Tumor Model

Recent developments in magnetic resonance guided focused ultrasound (MRgFUS) have facilitated the non-invasive, transcranial ablation of centrally located brain tissue targets. However, with an increased incidence angle promoting the absorption and scattering of ultrasound waves into off-target regions, it remains difficult to lesion peripheral points without harming adjacent tissue and bone. We proposed that MRgFUS coupled with cavitation nuclei contrast agents could mechanically ablate brain tumors using lower energy than thermal ablation, reducing off-target damage. We investigated this using a glioma rat model, injecting rats transcranially with U87 LucNeo tumor cells whose establishment and proliferation could be monitored non-invasively via quantifiable bioluminescence. Glioma rats were either reserved as controls or subjected to a cavitation nuclei coupled MRgFUS intervention. Ablative effects and focused ultrasound positional accuracy were evaluated via acoustic radiation force imaging (ARFI) and MR thermometry immediately before and after treatment. Our preliminary luciferase data showed minimal tumor cell death following microbubble-facilitated ablation, which was supported by ARFI images that revealed cavitation occurring in the immediately surrounding vasculature rather than within the tumor. Following these results, MRgFUS was performed on the remaining intervention rats using nanoparticles rather than microbubbles, producing ARFI images that showed successful ablations within the tumor. Nanoparticles may have a an increased capability to accumulate within the tumor due to their smaller size and prolonged half-life in circulation. Going forward, we will continue to optimize MRgFUS and avitation parameters while refining our tumor model and expanding our study for robustness and replicability.

Poster 2

Presenter: Tyria Heath (Grinnell College)
Mentor: Adam De Havenon (Neurology)
American Indians/Alaska Natives and Stroke Risk Factors and Treatment in Rural and Urban Locations

Native Americans have high rates of cerebrovascular risk factors and disease compared to other races/ethnicities. In relation to geographical location, NA stroke incidence may be greater in rural locations. Also, Native Americans may face disparities in acute stroke treatment. To further understand these public health issues, we created a cohort from the 2016-18 National Inpatient Sample to investigate the rates of stroke risk factors and acute stroke treatment (intravenous alteplase, tPA) in Native Americans (NA) compared to other races/ethnicities, and in rural versus urban patients. Patients with a primary discharge diagnosis of ischemic stroke (ICD-10 I63) were included.

We included 1,438,575 hospital discharges with stroke in our analysis, of which 6,515 (0.5%) self-identified as NA. Compared to other races/ethnicities represented in NIS (White, Black, Hispanic, Asian or Pacific Islander, and other), NAs with ischemic stroke had the highest rate of living in a rural location at 20.6%, with the second highest rate being 8.5% for White stroke patients ($p<0.001$). Rural NAs had the second highest rate of hypertension at 85.1%, the highest rate of diabetes at 54.9%, the second highest rate of congestive heart failure at 19.4%, and the second highest rate of obesity at 15.3%. Compared to White patients, NA patients had an adjusted odds ratio for receiving tPA of 0.69 (95% CI 0.55-0.86, $p=0.001$) in the full cohort and, in the cohort of rural patients, of 0.39 (95% CI 0.16-0.94, $p=0.036$). Additional research is needed to better understand the cerebrovascular health disparities that NA communities face.

Poster 3

Presenter: Madison Whitekiller (Northeastern State University)
Mentor: Dr. Dipayan Chaudhuri (Internal Medicine)

The Pharmacological Inhibition of the Inner Membrane Anion Channel

Heart failure affects approximately 6.2 million people in the U.S., and is caused by a lack of energy needed by the heart to pump blood to the body. The synthesis of the high energy compound, ATP, is executed in the mitochondria. A main reason for heart failure is ischemia-reperfusion damage that occurs during heart attacks. Ischemia leads to mitochondrial dysfunction, and the sudden increase in oxygen during reperfusion causes a burst of reactive oxygen species (ROS) production within these organelles. To escape mitochondria and cause cytoplasmic damage, this ROS utilizes an inner membrane anion channel (IMAC), a mysterious channel whose normal function and encoding gene remain unknown.

Developing pharmacological inhibitors of IMAC may be beneficial in heart failure research by preventing cytoplasmic ROS escape during ischemia-reperfusion injury. For this purpose, a 2000 drug library was screened via a novel fluorescent assay using the mitochondrially-targeted anion sensor mt-ClopHensor. Following the initial assay, we performed a secondary screen of the top hits. Primary results indicate that molecules with a flavone backbone, typified by the common plant flavonol quercetin, consistently inhibited IMAC activity with a Z-score of 6.073. These findings support years of knowledge that flavones exhibit anti-oxidant activity. Our data demonstrates that part of this activity may be due to inhibition of IMAC. This is a promising find for the inhibition of IMAC as a potential treatment for heart disease.

Poster 4

Presenter: Tina Ngo (Southern Utah University)
Mentor: Aylin Rodan (Internal Medicine)
Characterizing a Salt-resistant Mutant in Drosophila melanogaster

Our lab uses *Drosophila melanogaster (*fruit fly) to understand the effects of salt on the body. We previously showed that a heterozygous mutation (*EY-P283/+)* in the gene *locomotion defect* (*loco*) protects against death on a high salt diet. To further characterize *loco* mutant flies, we performed the following assays: 1) Wing measurements: *EY-P283*/+ flies have larger body weight relative to controls. To determine whether the larger body weight in *EY-P283*/+ flies is due to larger body size, I dissected out the left wing of male and female flies and imaged them using a microscope. Male but not female *EY-P283*/+ wings were larger than controls. 2) Climbing assay: Homozygous *loco* mutation impairs the climbing ability of flies. However, it was not known whether *EY-P283*/+ flies have impaired locomotion. My data revealed that female *EY-P283*/+ flies do not show significant differences in their climbing ability. However, relative to the controls, male *EY-P283*/+ flies demonstrated enhanced climbing ability. 3) Smurf assay: Gut barrier function is essential for survival and deteriorates with age. As *EY-P283*/+ flies have a longer life span, we tested whether they have a better gut barrier function using the SMURF assay. I found that there is no significant difference between the gut barrier function of aged *EY-P283*/+ and aged control flies. This suggests that the longer life span observed in *EY-P283*/+ flies is not due to impaired gut barrier function. Overall, the aim of this study was to characterize this heterozygous mutant and to better understand its salt resistance.

Poster 5

Presenter: Caton Weinberger (University of Utah)
Mentor: Lee Raby (Psychology)
Attachment Security as a Predictor of Receptive Language Vocabulary among Children Experiencing Adversity

There is a disagreement in the field of attachment theory over whether infant attachment security predicts language outcomes in early childhood. There is a strong theoretical argument against such an association, which has been challenged by empirical evidence supporting such an association in recent decades. The aim of this study was to examine whether infant attachment security predicts language development among a relatively large sample of children who experienced early adversity. The attachment security and receptive language vocabulary of 493 children were measured using the Strange Situation Paradigm and the Peabody Picture Vocabulary Test-Revised, respectively. The association between attachment security and language outcomes was not statistically significant. This finding suggests that

attachment security may not contribute to children's language outcomes. Additional research is necessary to explain discrepancies between this study and previous studies. More exploratory analyses revealed that the language skills of children adopted internationally more closely resembled those of normative-risk children than children whose parents were referred to Child Protective Services due to allegations of maltreatment or children in foster care. These population differences suggest that children's post-adoptive environments may be more important in shaping language outcomes than early experiences of adversity.

Poster 6

Presenter: Tran Diep (Brigham Young University)
Mentor: Taylor Sparks (Materials Science and Engineering)
Descending from Stochastic Clustering Variance Regression (DiSCoVeR) Algorithm for Suggesting Unexpected New Materials

Machine learning already enables the discovery of new materials by providing rapid predictions of properties to complement slower calculations and experiments. However, a persistent criticism of machine learning enabled materials discovery is that new materials are very similar, both chemically and structurally, to previously known materials. This begs the question "Can machine learning ever learn new chemistries and families of materials that differ from those present in the training data?" Here, we propose the Descending from Stochastic Clustering Variance Regression (DiSCoVeR) algorithm to systematically discover unintuitive and even unlikely yet promising candidates for new materials. The approach leverages clustering algorithms and introduces a loss function penalty for suggesting candidates close to clusters of known materials. Furthermore, we utilize the Earth Movers Distance approach with a modified Pettifor scale to encode chemical similarity in addition to the traditional composition-based features. We show an ability to extrapolate towards unexpected and unusual candidates.

Poster 7

Presenter: Charlotte Randolph (University of Utah)
Mentor: Jon Rainier (Chemistry)
Synthesis of VLC-PUFAs as Therapeutics for Macular Degenerative Diseases

Very Long Chain Polyunsaturated Fatty Acids (VLC-PUFAs) are non-dietary fatty acids that are more than 24 carbons long and include more than one double bond. The specific compound we are focusing on is 32:6 n-3: a 32-carbon molecule having 6 alkenes with the alkenes beginning at the omega 3 carbon position. These molecules are thought to be involved in the membrane structure of the retina and have been anecdotally linked to macular degeneration. This disease leads to a degradation in vision that comes with age and can result in blindness, it is currently the leading cause of untreatable blindness in the United Sates. The part of the synthesis we have been focusing on is the terminal oxidation. This is the final step of the synthesis and unfortunately is currently inefficient. This is at least partially due to the problems associated with the removal of DMF from the reaction mixture. While we would like to optimize this step, the alkene region is delicate limits the oxidants that we are able to employ. The all cis alkene region cannot be oxidized or isomerized. We believe that by changing the solvent system for this step, we can increase the efficiency for this step. We have found that other solvents will dissolve the Oxone necessary for this step and will result in the product being formed.

Poster 8

Presenter: Addison Bergman (Adrian College)
Mentor: Gabe Nagy (Chemistry)
High Resolution Cyclic Ion Mobility Separations of Isotopomers and Isotopologues

Cyclic ion mobility spectrometry coupled to mass spectrometry (cIMS-MS) is a powerful analytical technique that can rapidly separate out isomers and other structurally similar molecules in the gas phase under an electric field based on their size and shape (mobility). Isotopologues are molecules that differ only from substitutions of isotopes for one or more of their atoms (different number of neutrons). At high IMS resolving powers, isotopologues can theoretically be separated

based on differences in their reduced masses according to the Mason-Schamp equation. Isotopomers are isotopic isomers that have the same number of isotopes but in different locations. Theoretically, these molecules should not be resolvable since they possess identical structures and no differences in reduced mass. However, we hypothesized that since isotopomers differ in their respective center of masses, they might indeed be resolvable with our high-resolution cIMS-MS platform. To test our hypothesis, we selected a deuterated set of palmitic (hexadecenoic) acid isotopologues and isotopomers. Specifically, we selected the unlabeled (d0) and fully labeled (d31) isotopologues as anchors to establish our theoretical mobility trendline based on calculated reduced mass differences and expected negligible differences in their center of mass. By analyzing our two partially deuterated (d5) isotopomers in a set with our d0 and d31 anchors, we saw both d5 molecules deviated from the theoretical reduced mass trendline. This implies that center of mass contributions on top of reduced mass ones do play a role in the mobility differences of isotopologues. Additionally, we also observed that the two d5 molecules were slightly resolved from one another thus suggesting that center of mass contributions, alone, are responsible for the separation of isotopomers. Based on our findings, we believe that we will gain a better fundamental understanding of how shifts in center of mass will alter the observed mobility of ions and lead to predictive capabilities.

Poster 9

Presenter: Aric Potter (University of Utah)
Mentor: Joel Harris (Chemistry)
Confocal Raman Microscopy Investigation of Long-Chain Alcohol Monolayers on n-Alkyl-Chain Functionalized Silica Surfaces

Hybrid-supported lipid bilayers (HLSBs) employ an outer-leaflet of phospholipid self-assembled on an inner-leaflet of n-alkyl chains covalently bound to the surface of reversed-phase chromatographic silica. The structure of HSLBs has been characterized using confocal-Raman microscopy. The results show that acyl-chains of phosphatidylcholine are interdigitated with the n-alkyl chains, and the ordered chains undergo temperature-dependent melting transitions typical of lipid bilayers.

We recently showed that the structure of zwitterionic phospholipid hybrid bilayers can be mimicked by pairs of oppositely-charged surfactants with comparable head-group composition and hydrocarbon-chain lengths. The surfactant bilayers have additional benefits of providing freedom in head-group composition that controls partitioned solute interactions. To extend the range of surfactants employed to prepare ordered hybrid-bilayers on n-alkane modified silica, we have sought an alternative class of surfactants with neutral head groups (long-chain alcohols) to modify reversed-phase chromatographic surfaces. We have assembled saturated, long-chain alcohol monolayers on C18-modified silica and investigated their structure with confocal-Raman microscopy. The results reveal a stable layer of long chain alcohols, which does not desorb upon exposure to aqueous solution. Similar to hybrid-supported lipid and mixed-charge surfactant bilayers, the alcohol surfactant density and chain ordering are consistent with interdigitated hydrocarbon chains, exhibiting chain-length and temperature-dependent variation in their degree of n-alkyl chain order. In thermal experiments it was shown that the alcohol monolayer melts with the covalently bound carbon chains on the silica surface. This would strongly suggest interdigitation of the carbon chains. The hybrid alcohol structures demonstrate the ability to combine the stability of n-alkane-silane modified silica surfaces and customizability of interfacial properties with a stable, ordered monolayer of a long chain surfactant.

Poster 10

Presenter: Chermiqua Tsosie (Arizona State University)
Mentor: Elizabeth Keating (Pediatrics)
Implementing a Trauma Registry for Pediatric Injury Patients in Tanzania

Pediatric injuries in low-and-middle-income countries are a leading cause of morbidity and mortality worldwide. Research has found that implementing trauma registries can aid in reducing the knowledge gap between hospital care and patient outcomes. The goal of this study was to create a prospective pediatric trauma registry at Kilimanjaro

Christian Medical Centre (KCMC) in Moshi, Tanzania to provide insight into the epidemiology and outcomes of injured children. This is a prospective observational study in which a pediatric trauma registry was implemented at KCMC. Patients were enrolled by our research assistants who inputted data into REDCap©. Data was collected regarding patients' demographics, presentation to the hospital, hospital-based care, care needs after discharge, and morbidity measured by the Pediatric Glasgow Outcome Score-Extended (GOS-E) score. Data was analyzed using descriptive statistics. 236 patients have been enrolled in the registry. The majority were males (n=157, 66.5%), and the mean age was 8 years old. The leading causes of pediatric injuries were road traffic injury (RTI) (n=86, 36.4%) and falls (n=86, 36.4%). There were 13 deaths with a mortality rate of 5.7%. The majority of patients discharged from KCMC had upper and lower good recovery as measured by the GOS-E score. Males are more likely to be injured, and road traffic injuries are a leading cause of injury in children at KCMC. The mortality rate of injured children in our cohort is considerably high. Further research needs to be done to determine which clinical factors contribute to this high mortality rate.

Poster 11

Presenter: Tanner Hoole (University of Utah)
Mentor: Michael Vershinin (Physics & Astronomy)
Mechanical Properties of Microtubules as a function of temperature

Microtubules consist of hollow, fibrous shafts that function to support eukaryotic cell shape. These filamentous intracellular structures are also responsible for other functions in eukaryotic cells, including nucleic positioning, cell division, organization of intracellular structure, and intracellular transport.

Microtubules are the largest filaments (compared with actin and intermediate filaments) and commensurate with this, they possess the highest filament rigidity. However, research studying their mechanical properties is rarely focused on its temperature dependence despite the fact that even cells in multicellular thermoregulated organisms, such as mammals, tend to experience significant temperature variations. Our work is seeking to define the true rigidity of taxol-stabilized and non-stabilized microtubules as a function of temperature. Our preliminary results show a consistent trend of rigidity decrease with increasing temperature.

Poster 12

Presenter: Micah Devore (University of New Mexico)
Mentor: Simon Fisher (Pediatrics)
Metoclopramide Improves the Glucoregulatory Response to Hypoglycemia

Patients with insulin-treated diabetes are at high risk for low blood sugar (hypoglycemia) due to the development of an impaired glucoregulatory response. A drug screen identified metoclopramide as a potential agent that may restore hypoglycemia counterregulation. To test this hypothesis, 10-week old male Sprague Dawley rats underwent vessel cannulation and a recurrent hypoglycemia (RH: glucose 45±5 mg/dl) preconditioning protocol to induce a blunted glucoregulatory response. Metoclopramide (MET: 3mg/kg IP) or saline (CON: control) was administered during this preconditioning period. On day 7, hyperinsulinemic (50 mU/kg/min) hypoglycemic clamps were conducted. By experimental design, blood glucose was similar in both groups during the basal period (MET: 101±2 mg/dl, CON: 105±2 mg/dl) and fell to a similar extent in response to insulin infusion (MET: 42±1 mg/dl, CON: 42±1 mg/dl, P=NS). The glucose infusion rate required to maintain hypoglycemia was lower in the MET treated group (18±2 mg/kg/min) as compared to CON (42±1 mg/kg/min, $P<0.05$). In conclusion, treatment with metoclopramide improved the endogenous glucoregulatory response to hypoglycemia and may therefore be efficacious treatment to diminish the risk of hypoglycemia in patients with insulin treated diabetes.

Poster 13

Presenter: Summer Furrer (University of Utah)
Mentor: Melodie Weller (Dentistry)

Cellular Localization of Hepatitis Delta Virus in Sjogren's Syndrome Salivary Gland Tissue

Background:
Sjogren's syndrome (SS) is an autoimmune disease, predominantly affecting women, causing dry eyes, dry mouth, fatigue, and pain throughout the body (Le Goff et al., 2017). In a previous study, 50% of evaluated SS patients were found to have hepatitis delta virus (HDV) antigen in salivary gland tissue. Furthermore, HDV reproduced a SS phenotype when cannulated into mice salivary glands (Weller et al., 2016). Further studies are required to better understand HDV's role in SS; therefore, a study was designed to evaluate HDV profiles in a cohort of six SS and two Sicca patients.
Methods:
A focus score of 1 (≥50 inflammatory cells in 4mm2 area) or greater is indicative of focal sialadenitis: one of many components of SS diagnoses (Segerberg-Konttinen et al.,1986). To assess the extent of focal lymphocytic infiltration, Hematoxylin and Eosin (H&E) staining was performed on FFPE human salivary gland tissues. Slides were mounted and imaged. The area of salivary gland within each slide was obtained and the number of foci/4mm2 were calculated. All tissues then underwent immunohistochemical analysis using targeted antibodies for HDV antigen and subcellular localization markers. Slides were mounted and imaged. Localization of HDV antigen and subcellular markers were analyzed.
Results:
Tissue samples were classified using the 2016 American College of Rheumatology and the European League Against Rheumatism (ACR/EULAR) criteria (Shiboski et al., 2017). Based on respective patient data and focus scores, six samples were classified as SS, and the remaining two were classified as Sicca. Once tissue was stained with anti-HDAg and subcellular localization markers, there were regions of localization between select organelles and the HDV antigen. Further studies of SS salivary gland biopsies are needed to confirm these findings.

Poster 14

Presenter: Dallen Calder (University of Utah)
Mentor: Stavros Drakos (Internal Medicine)

The Role of Adipocyte Enhancer Binding Protein 1 (AEBP1) in Cardiac Fibrosis Progression and its Potential as a Therapeutic Target.

Fibrosis is a major hallmark of heart failure (HF) progression and is characterized by fibroblast activation and excess extracellular matrix production. Left Ventricular Assist Devices (LVAD) are used as bridge-to-transplant therapy in HF patients. A small subset of HF patients showed both structural and functional improvement (referred to as responders). Some responders who originally displayed high cardiac fibrosis showed a significant reversal of fibrosis (n=6, p=0.0228) upon LVAD unloading. RNA sequencing on myocardial tissue acquired from these patients suggested a significant upregulation of Adipocyte enhancer binding protein (*Aebp1).* AEBP1 is a secreted protein that serves as a fibroblast activator upstream of αSMA and has been repeatedly identified in lung and liver fibrosis studies as a potential therapeutic target. However, its role in cardiac fibrosis requires further investigation. Using human cardiac fibroblasts (HCF), we showed that TGFβ stimulation causes fibroblast activation evident from increased SM22 (n=6, p=0.0001), αSMA (n=6, p=0.03) and increased phosphorylation of SMAD (n=6, p=0.0002). We also observed a significant increase in AEBP1 upon stimulation, suggesting that AEBP1 plausibly plays a role in fibroblast activation. In order to determine the role of AEBP1 in fibrosis progression we used *in-vitro* overexpression and knock-down models. We observed a significant upregulation of αSMA upon AEBP1 overexpression in the unstimulated HCF population (n=2, p=0.0037) suggesting AEBP1 can independently lead to fibroblast activation and fibrosis progression. Similarly, AEBP1 knock-down experiments showed a significant decrease in SM22 (n=2, p=0.01) upon stimulation when compared to the control group suggesting AEBP1 is essential to the process of fibroblast activation. While additional in vivo experiments are necessary and will be conducted in the future, our results suggest that AEBP1 is an essential component in the molecular processes that underlie fibrosis formation in the heart and is a potential therapeutic target for reverse remodeling.

Poster 15

Presenter: Alison Wang (University of Utah)
Mentor: Caroline Saouma (Chemistry)
Conversion of CO2 to CO Using Mn Electrocatalysts

Carbon dioxide emissions have long been a source of concern for global warming. With organizations such as the UN commenting that we only have eleven years to prevent irreversible climate change, we need to find methods of reducing our carbon dioxide emissions. Transition state metal electro-catalysts have previously been shown to convert carbon dioxide to carbon monoxide. When H2 is added to carbon monoxide through the Fischer- Tropsch process, liquid fuel can be generated thus recycling our carbon dioxide emissions. There are rhenium and ruthenium complexes that effectively do this, however, they are rare metals and thus expensive to use on an industrial level. Currently, research is being conducted on how to use manganese, a more abundant metal, with different ligands to effectively convert carbon dioxide into fuel precursors. The bpy-manganese complex in this presentation electro-catalytically reduces carbon dioxide to carbon monoxide. My poster describes the proposed mechanisms and intermediates of this reduction. Of note, if we characterize these intermediates, we can potentially induce a protonation-first pathway that would require less energy input for this reduction. By synthesizing these intermediates and characterizing them, we can confirm this mechanism and gain more insight into how we need to change conditions and ligands to better reduce carbon dioxide.

Poster 16

Presenter: Molly Griston (University of Rochester)
Mentor: Lauren Barth-Cohen (Educational Psychology)
Students' use of consistency checks while sensemaking in inquiry-based labs

With the growing implementation of reform-based labs in physics, students are no longer following rote procedures and are instead expected to utilize complex experimental skills like measurement uncertainty, experimental modeling, and computation, which require students to engage in sensemaking. However, most literature on sensemaking in physics instruction focuses on lecture and problem-solving contexts rather than laboratories. This study identifies a type of sensemaking process that occurs in laboratory settings, namely consistency checks. A consistency check is when a student identifies an element of the data and checks whether that element is consistent with their knowledge of the relevant system. The roles of consistency checks are analyzed in the context of Introductory Physics for Life Sciences (IPLS) labs at the University of Utah. We use an open-ended narrative analysis to identify potential paths students can take while engaging in sensemaking during lab experimentation through consistency checks. We then examine two student groups that utilize consistency checks in this lab environment and discuss these checks in terms of how they encourage deeper thinking about the experiment and affect the groups' experimental processes. The identification of consistency checks as a productive process utilized by students has a broad range of instructional implications for inquiry-based labs. Instructors' abilities to identify and encourage the use of these checks has the potential to improve students' sensemaking abilities and overall understanding of physical mechanisms in biological contexts.

Poster 17

Presenter: Joselyn Clark (Eastern Connecticut State University)
Mentor: Natalia Torres (Pediatrics)
Targeted Disruption of the Nuclear Factor of Activated T-cells (nfatc1) Increases Atrial Fibrosis in Zebrafish

Atrial fibrillation (AF), a common arrhythmia that impacts 5% of people 65 and older, can lead to life threatening conditions such as stroke and congestive heart failure. A subtype of AF, called familial AF, has a genetic component, and impacts individuals as young as 20 years old. Our previous research identified a novel mutation (M527L) in the transcription factor NFATc1 gene in a family with a young-onset AF phenotype. It is currently unknown if NFATc1 is involved in the development of fibrosis (increased fibrous tissue) in the atria, a hallmark of AF. The aim of this work is to study if nfatc1 is involved in atrial fibrosis generation in a zebrafish model of nfatc1 deficiency. We will use Wheat Germ

Agglutinin (WGA) 555 staining to measure atrial fibrosis of adult zebrafish (Danio rerio) expressing the cardiac marker cmlc2:GFP. While WGA-555 is not widely used to measure fibrosis, the gold standard techniques limit simultaneous staining and disallow thick slicing that better preserves tissue structure. Explanted and fixed atria from wild type (WT), nfatc1-/+ (heterozygous), and nfatc1-/- (homozygous) zebrafish were sliced (100 um) and stained with WGA-555 and Hoechst (nuclear staining). 3D stacks were acquired with a confocal microscope and analyzed using ImageJ. I have established the ideal conditions for WGA-555 staining in zebrafish atria and I am quantifying fibrosis for each phenotype. I anticipate that nfatc1-/- will have increased amounts of fibrosis. Our findings will help identify the role of nfatc1 in atrial fibrosis generation and its possible contribution to AF.

Poster 18

Presenter: Natalie Flores (Southern Utah University)
Mentor: Yelena Wu (Dermatology)
Exploring the Relationships between Family Function, Depression and Anxiety among Children of Melanoma Patients

Malignant melanoma is expected to increase at a rate of 4.8% in 2021, which helps to account for increased mortality rates (Skin Cancer Foundation, 2021). A person receives up to 80% of their lifetime sun exposure from early childhood through adolescence, making childhood a crucial time to reduce sun exposure and therefore melanoma (Boe, 2006). Depression and anxiety are linked to risky health behaviors, and family dysfunction is linked to health risk factors later in life (Soleimani, 2017); (Felitti,1998). The current study addresses the following question: Do children experiencing higher levels of depression and anxiety, or higher family dysfunction, also use sun protection behaviors less often?

Melanoma survivors and their children were recruited for a pilot study testing a melanoma preventative intervention by way of flyers at medical clinics, online and in-person advertisements, or through prior participation in Huntsman Cancer Institute studies. During study visits, participants completed questionnaires and received a behavioral intervention that included information on behavioral and organizational strategies to promote melanoma prevention.

Analyses assessed correlations between sun protection and depression, anxiety, and family functioning. These measures were assessed using parent report on child behavior. The PROMIS measures assessed anxiety and depression, and the Family Assessment Device assessed family functioning.

Results did not indicate a significant correlation between the sun habits survey index and anxiety, depression, or family functioning. Children experiencing higher levels of depression and anxiety, or higher family dysfunction, did not necessarily demonstrate lower use of sun protective behaviors. Future analyses may consider a larger sample size and may also assess child self-report in addition to parent report on child behavior. Lastly, future studies may consider qualitative interviews to assess depression, anxiety, and family functioning.

Poster 19

Presenter: Mark Paine (Carleton College)
Mentor: Miguel Pereira (Chemistry)
Purification and Quantification of HIV Genomic RNA

The goal of my project was to quantify counts of HIV genomic RNA from purified virions. This would allow for more accurate quantification of the efficiency of Endogenous Reverse Transcription reactions pioneered in the Sundquist Lab. Current methods to do this in the lab utilize the concentration of the HIV CA protein in the virions. I investigated a more direct way to quantify these counts of HIV genomic RNA by using Quantitative reverse transcription PCR (RT-qPCR). HIV genomic RNA had to be purified and isolated before it could be quantitated using qPCR. Virion samples were first treated with DNase, followed by Proteinase K. Total RNA was then selectively bound to columns using a GeneJET RNA purification kit, followed by elution. This total RNA, including the target genomic HIV RNA, was then used as a template for the SuperScript III (SSIII) First-Strand Synthesis System. The synthesized cDNA was then amplified, with the

initial amount of cDNA quantitated by qPCR. A second derivative maximum analysis was performed on the amplification curves obtained by the LightCycler, which examined at which cycle the fluorescence of each well was most rapidly increasing. This "Cp" value is inversely related to the amount of target RNA initially present. These Cp values were fitted along a standard curve to attain a measure of Late RT copies per well, which was then converted into an estimate of Late RT copies per HIV genome using known dilution and initial concentration values.The absence of the SSIII enzyme in this procedure yielded very low signal. The signal in the presence of SSIII was independent of DNase concentration, leading to the use of 1x DNase in further trials. Absence of the FST-rev primer decreased the signal, but not to the extent of the absence of SSIII.While substantive progress was made toward determination of a quantitative readout of HIV genomic RNA copies per virion, future experiments that incorporate an internal control that corrects for possible SSIII reaction inefficiency and binding affinity of the GeneJET RNA column are still necessary

Poster 20

Presenter: Vianey Quaney (University of Texas at El Paso)
Mentor: Rebecca Utz (Sociology)
Recruiting Hispanics for a Research Study on Family Caregiving

More than 53 million persons in the U.S. are family caregivers, meaning they provide personal care support and/or medical care to a friend or family member in the home and in our communities. Respite is defined as a short period of relief from difficult tasks associated with family caregiving. It is the most sought out resource for caregivers. However, many caregivers are hesitant to use respite services. This is particularly true for Hispanic caregivers. Many Hispanics do not identify as a "caregiver" when they are caring for a family members. Some Hispanic caregivers do not realize the benefits associated with respite, while others do not realize that it is a resource they have access to. This is likely due to the fact that the advertisements for these resources do not resonate with many Hispanic caregivers. During the summer of 2021, I worked with a multidisciplinary team on a research project funded by the NIA known as Time for Living and Caring (TLC). Team members of the TLC project have developed an intervention in the form of an online "app" that supports dementia caregivers who want to use respite services. The TLC research team is currently recruiting participants to evaluate the TLC intervention, but has not had much success in recruiting Hispanic caregivers to participate in the study. Given that recruitment of Hispanic populations is particularly difficult, I worked on a special project to develop unique strategies to recruit, engage, and retain Hispanic populations in the study.

Poster 21

Presenter: Jared Zollinger (University of Utah)
Mentor: Frank Sachse (Bioengineering)
Remodeling of Microstructures Associated with Cardiac Excitation-Contraction Coupling and Etiology Based Effect on Heart Function in Patients with End Stage Heart Failure

Cardiovascular disease is the leading cause of the death worldwide. Heart failure (HF) currently afflicts 64.34 million people worldwide and accounts for nearly $350 billion in medical costs each year in the United States alone. Given the incredibly high worldwide prevalence, understanding the mechanisms and the factors which contribute to HF is essential. HF is defined as the inability of the heart to pump adequately leading to functional impairment. Typically, this involves loss of contractile function stemming from remodeling or damage to the myocardium, or the cardiac muscle tissue. Cardiomyocytes, or cardiac muscle cells, are the predominant cell in the myocardium and are responsible for the contractile function and electrical signaling of the heart. Critical to cardiomyocyte structure are the transverse tubular systems (t-system), tubular invaginations of the sarcolemma (SL) which contain pathways essential to cell communication. These communication pathways include ryanodine receptors (RyRs), and junctophilin-2 (JPH2) which were of interest in this work. Remodeling of the cardiomyocytes, including loss of the t-system, RyRs, and JPH2 have been identified as a root cause of HF. The contractional function of the myocardium is directed by the RyRs found along the t-systems.

In this study, the cardiomyocyte structures and the left ventricular ejection fractions among differing etiologies of ischemic myocardium, non-ischemic myocardium, and control myocardium are investigated. Using laser confocal microscopy, tissue samples were imaged and analyzed for relationships between cardiomyocyte structure and heart function. It was revealed that non-ischemic HF patients have a higher rate of recovery when compared to ischemic HF patients. Additionally, a statistically significant correlation between the mean distance between t-tubule systems and left ventricular ejection fraction (a measure of heart function) was shown. Similar analysis was performed with RyRs and JPH2, however the results were not significant among etiologies.

Poster 22

Presenter: Pear Intasin (Carleton College)
Mentor: Mai Tran (School of Biological Sciences)
Viral tissue tropism of a picornavirus in two different zebrafish lines

Zebrafish, highly amenable to genetic and chemical manipulations, have gained ground as a model organism for studying virus-host interactions because of their conserved antiviral response. Among human viral illnesses that can be modelled in zebrafish, there are some viruses such as HSV-1 and HCV that target central nervous system tissues and cause seizures, lethargy and tremors in zebrafish. Previously, Balla et al. (2020) discovered an endemic picornavirus (ZfPV) affecting zebrafish worldwide. Infection, while asymptomatic, triggered a strong immune response in the gut. Interestingly when comparing the infection in different strains of zebrafish, the researchers detected high levels of virus in the intestine, gills, and brain of a clonal laboratory line (CG2), while ZfPV levels in the Tübingen strain (TU) are lower for the intestine and gills, and not detected in the brain. It remains unclear the cellular and molecular mechanism underlying differences in infection susceptibility between the two strains.

In this study, using immunohistochemistry, I investigated the isg15 spatial expression in infected CG2 and TU. isg15 expression is a readout for interferon signaling - a conserved vertebrate antiviral response. The results showed that upon infection, isg15 was expressed in the intestine of both infected CG2 and TU larvae suggesting strong interferon responses in the gut of both strains. In contrast, I only observed isg15 expression in the spinal cord of CG2 but not TU larvae suggesting a differential immune response in neuronal cells. Further studies using genomic approaches are pivotal to understand the differences in susceptibility to infection and the involvement of the central nervous system in the antiviral responses of these two different zebrafish species.

Poster 23

Presenter: Chantelle Yazzie (Utah Valley University)
Mentor: Owen Chan (Internal Medicine)
The Efficacy of the Novel Somatostatin Receptor 2 Antagonist, ZT-01, to Restore Glucagon Secretion in Diabetic Rats.

Loss of the ability to secrete glucagon in individuals with Type 1 diabetes (T1D) places them at greater risk for experiencing hypoglycemia or "low blood sugars", which is a major problem for those patients placed on intensive insulin therapy. While the reason underlying this loss is not known, one mechanism that has been proposed is the increase in somatostatin secretion that is observed in T1D. As somatostatin normally inhibits glucagon secretion, blocking its actions may be one potential therapeutic strategy to help restore the glucagon response to hypoglycemia in T1D patients. We previously showed that the novel somatostatin receptor 2 antagonist, ZT-01, exhibited good efficacy in restoring glucagon responses to hypoglycemia in two-week, poorly controlled streptozotocin-diabetic rats, when given subcutaneously one hour prior to hypoglycemia onset. The goal of the current study was to determine the ideal dose timing strategy for ZT-01. We examined the efficacy of ZT-01 when administered either 3 or 6 hours prior to the induction of hypoglycemia (45±5mg/dl) using a hyperinsulinemic-hypoglycemic clamp. Our initial data shows that ZT-01 enhances glucagon secretion to hypoglycemia when given 3 hours prior to the induction of hypoglycemia compared to vehicle-treated diabetic animals (VEH: 62±8, ZT-01: 156±41, $P<0.05$), but the efficacy is lost when given 6 hours prior to hypoglycemia induction (VEH: 78±16, ZT-01: 87±15, P=NS). In conclusion, antagonism of type 2 somatostatin receptors with ZT-01 may

be a promising therapy to restore glucagon secretion in diabetic patients when given up to three hours prior hypoglycemia onset.

Poster 24

Presenter: Makenzie White (Dixie State University)
Mentor: Jay Mace (Atmospheric Sciences)
Cloud and Precipitation Property Sensitivity to Volcanic Aerosol Downstream of Marine Volcanoes

The marine volcano Kilauea in Hawaii erupts periodically and releases sulfur dioxide (SO_2) into the atmosphere. Once sulfur dioxide enters the atmosphere it interacts with the hydroxide ion (OH^-) in the gas phase to create many different aerosol sulfate products, including sulfuric acid (H_2SO_4). The sulfate aerosol affect the microphysics of clouds downstream of Kilauea, which can be shown using the CloudSat overpass, and can be seen in Worldview images. The CloudSat data can affectively be used to interpret differences in the aerosol optical depth of clouds within a sulfate aerosol stream and clouds outside said stream. We present two case studies in which there were different aerosol optical depths. One case had a lower overall optical depth, while the other had a higher optical depth and it was shown that there was higher fractional depth in the plume downstream of Kilauea. This is found to be consistent with the work of Mace and Abernathy (2016).

Poster 25

Presenter: Liyanna Lee (Northern Arizona University)
Mentor: Marcus Pezzolesi (Human Genetics)
Accelerating Genetic Discovery in Diabetic Kidney Disease Using 'Big Data' and Archived Biospecimens

Diabetic kidney disease (DKD) affects nearly 40% of all patients with diabetes and is the leading cause of end-stage renal disease. While genetic factors are known to contribute to disease susceptibility, the identification of causal genes and the translation of genetic findings to improved care has been challenging. High-throughput next-generation sequencing technology offers an opportunity to better understand DKD susceptibility and its phenotypic variation. To advance this area of investigation, we are leveraging electronic medical records to deeply phenotype and select patients of interest, extensive genealogy data from the Utah Population Database to identify high-risk families, and next-generation sequencing to identify disease-causing variants. While this workflow promises to accelerate discovery in this area, acquiring biospecimens for genetic analyses remains a bottleneck. In an attempt to alleviate this, we recently linked individuals from high-risk rapid renal decline pedigrees with biospecimens available in the Intermountain Biorepository, a resource that includes more than 4.5 million biological samples. The purpose of this pilot study is to evaluate biospecimen samples (n=14) from 2 high-risk pedigrees obtained from the biorepository using whole exome sequencing. For this study, FASTQ files from paired-end sequencing were aligned and processed for variant detection using the Sentieon Genomics DNASeq software pipelinethat incorporates the Broad Institute's BWA-GATK Best Practices Workflow. The anticipated outcome of this study is the identification of high-quality rare variants and the confirmation that archived biospecimens from the Intermountain Biorepository can provide a rapid source of genetic material to accelerate studies aimed at discovering novel disease genes.

Poster 26

Presenter: Jaidyn Probst (Harvard University)
Mentor: Nelangi Pinto (Pediatrics)
Barriers to Accurate Prenatal Ultrasound Screening for Congenital Heart Disease

We aimed to determine barriers to effective prenatal ultrasound screening for congenital heart disease (CHD) at different representative settings where screenings are performed within the Intermountain Healthcare system. We conducted semi-structured interviews and site visits at a high volume tertiary maternal fetal medicine clinic (MFM), a high volume community obstetric (OB) clinic, and a medium volume community radiology department. Study staff interviewed

providers and audio-taped and transcribed the interviews. Site assessments and interviews were analyzed using a rapid analytics method to identify common and diverging themes. From 1/21 to 7/21, 20 interviews were conducted (10 sonographers, 2 clinical managers, 8 physicians). Common themes identified include lack of education/knowledge surrounding detection of CHD, variability in communication/feedback between sonographers and interpreting physicians, and lack of self-efficacy amongst sonographers in their screening abilities. While there are common barriers to effective screening across types of imaging settings, there are also site specific barriers. Those identified included late gestation referrals at the MFM site, high volume and time stressors at the OB clinic, and lack of volume/experience at the radiology site. Certain facilitators to detecting CHD were identified as well, which include hands-on training, support from physicians and fellow sonographers, and patient cooperation. This identification of predominant barriers and facilitators will aid in targeting interventions/resources. Incorporating necessary site specific adaptive elements will support more effective prenatal ultrasound screening, ultimately increasing detection rates for CHD.

Poster 27

Presenter: Abena BakenRa (University of California, Berkeley)
Mentor: Daniel Chavez-Yenter (Communication)
Exploratory Content Analysis of Prenatal Genetic Testing of Twitter Users

The increased use of Direct-To-Consumer (DTC) genetic testing within the U.S. and other countries has led to questions about the comprehensive nature of this test and the insight of risk that is provided. As DTC genetic testing has become more commercialized, the availability of genetic counselling has not increased to match the demand, raising ethical and practical concerns over the use of such tests in a reproductive context. Despite these challenges, social media provides an opportunity for patients to be autonomous in their education outside of a clinical setting. Yet, little is known about the accuracy of the information or the influence of online conversations on motivations to test across popular social media platforms, such as Twitter. The popularity and formatting of Twitter allow researchers to study naturally occurring conversations in real-time. However, there remains a gap in research regarding the attitudes of Twitter users surrounding prenatal testing and the types of information Tweeted, this study will work to address this gap. In this exploratory content analysis, 1101 unique Tweets were collected for analysis over one week in July 2021 to explore online conversations. The data were collected through the RTweet package and analyzed through RStudio using the Text Mining package. The study involved a mixed-method approach, initially quantifying word occurrences for quantitative content analysis, and then a qualitative content analysis approach to interpret the credibility of the Tweets and their themes. Education/advocacy, eugenics/ethics, and international misuse emerged as themes from analyzed Tweets. The themes have great potential as influences of social norms and motivation to DTC GT. Though the study is exploratory, it provides useful insights into the importance of Twitter as a moderator of social influences and as a tool for health education.

Poster 28

Presenters: Manuela Herrera & Angel Valenzuela (University of Utah)
Mentor: Daniel Mendoza (Environmental & Sustainability Studies)
The relationship between Adverse Health Outcomes and Air Quality among Minority Communities .

There is a vast wealth of knowledge and studies on the relationship between air quality and harmful health outcomes. The increased availability of granular data has enabled researchers to confirm the hypothesis that minorities and low-income communities are disproportionately impacted by negative air quality. However, little work has summarized and mapped the novel advancement in the last six years of research. Thus, we conduct a scoping review on the literature from January 2015 to December 2020 concerning the effects of outdoor air quality and air pollution (precisely criteria pollutants) on deleterious cardiovascular and pulmonary human health outcomes in various adult populations and locations in the United States. Once complete, the review will summarize the conclusions and gaps in the literature to inform policymakers about the inequities that result from ineffective and ill-informed policies are air quality.

Poster 29

Presenter: Nadine Gabriel (Youngstown State University)
Mentor: John Horel (Atmospheric Sciences)
Analyzing Utah Division of Air Quality Forecasts of Ozone Near the Great Salt Lake during Summer 2021

The Utah Division of Air Quality (DAQ) forecasts air quality for public health. The DAQ often finds it difficult to predict ozone concentrations. We determined the accuracy of the DAQ ozone forecasts of high ozone periods (>80ppbv) from June 4th to July 16th, 2021. From the MesoWest Interface, we had collected 43 one-day ozone forecasts from Utah DAQ sites from four locations, Bountiful (QBV), Inland Port (QIP), Hawthorne (QHW), and Rose Park (QRP). Out of 43 days, the ozone concentrations were accurately forecasted 21 days, under forecasted 7, and over forecasted 15. This study helps to prepare for a Summer 2022 filed study on high ozone periods in the Great Salt Lake Area.

Poster 30

Presenter: Ashlynn Searer (University of Utah)
Mentor: John Horel (Atmospheric Sciences)
Impact of Lake Breezes on Ozone Concentrations Near The Great Salt Lake from 2015-2020

The Utah air quality has faced high ozone concentrations due to a multitude of factors ranging from natural to anthropogenic influences. These high ozone concentrations have an impact on public health and the environment near the Great Salt Lake (GSL), Utah. We document ozone concentrations at Utah Division of Air Quality stations at Bountiful and Rose Park from May 2015 until September 2020 that exceed both 80ppbv and 95ppbv. Utilizing MesoWest web tools, we created time series and tables that displayed trends found and to explain probable causes of these episodes. Two case studies, one impacted by a lake breeze and the other by regional wildfires, are examined where the ozone concentrations were greater than 80ppbv. This work will help inform planning for a summer 2022 field study in the GSL area.

Poster 31

Presenter: Salma Rios & Jorge Jimenez (University of Utah)
Mentor: Robert Welsh (Psychiatry)
Biological and Environmental Mechanisms of Risk and Resiliency in Brain Aging Among Ethnic Minorities

Salt Lake County (SLCO) has a known and ongoing problem with air pollution. However, air pollution in SLCO does not impact everyone to the same extent. More affluent communities, which are predominately White in SLCO, are less exposed to air pollution for a variety of reasons. The primary one is location, as most affluent communities are found at higher elevations alongside the Wasatch Bench. They do not have the producers of pollution close to their communities. Conversely, Black and Communities of Color live in some of the oldest, lowest elevation housing in the valley. Their communities are surrounded by causeways, industrial factories, and landfills. All of these create pollution. What is concerning is that long-term exposure to pollution has been shown to impact all aspects of a healthy life. Research has linked pollution exposure to increased mortality rates, repertory and cardiovascular health problems, and even cognitive symptoms similar to those shown in Alzheimer's disease patients. The research done on this topic is sparse, since historically speaking, most research participants have been White. This has led to Black and People of Color being excluded from research studies and few researchers have attempted to understand the reasoning for this. The barriers that limit the involvement of communities of color in research are an important aspect of the study since the research team is working to be more inclusive.

Poster 32

Presenter: Tavie Parker (University of Utah)
Mentor: Makoto Kondo (Pharmaceutics & Pharmaceutical Chemistry)
Effects of Basic Fibroblast Growth Factor on Human Bone Marrow Mesenchymal Stem/Stromal Cell Expansion & Scalability

Mesenchymal stem/stromal cells (MSCs) continue to attract significant scientific and clinical interest as cellular therapies due to their ability to replace/repair damaged tissue via multipotent differentiation and direct host cell activity via paracrine signaling. However, MSC therapeutic efficacy for localized disease treatment continues to be hindered by a reliance on suspended cell injections or infusions that demonstrates low cell engraftment, retention, and survival at the injury site. This cell delivery challenge drives the development of new tissue engineering methods to improve MSC delivery efficiency to target tissues, such as Utah's cell sheet engineering. MSC sheet use in cell therapy necessitates a standardized set of optimal culture conditions for reproducible clinical scale production in order to provide the most reliable clinical results. This research investigates the effect of the common protein additive basic fibroblast growth factor (bFGF) on human bone marrow-derived MSC (hBMSC) expansion and scalability for cell sheet applications. bFGF is the most commonly used growth supplement in MSC culture media to promote cell proliferation, yet its effects on intrinsic cell therapeutic functions are not comprehensively characterized and are primarily limited to single-cell suspensions.

Poster 33

Presenter: Loren Brink (Stony Brook University)
Mentor: Steve Krueger (Atmospheric Sciences)
Wildfires: Rate of Spread Through The Lens of Models and Simulations

This project focuses on how different factors of wildfires influence their rate of spread. Two fire spread models, the Balbi Model and QES-Fire, are explored. The differences between them and how they work together are discussed. Using QES-Fire, resolution studies are done on varying fuel moisture contents, wind speeds, fire line widths and wind directions. The results of this project confirm what we would expect from these models based on previous knowledge and research on wildfires. The System for Atmospheric Modeling, known as SAM, is briefly discussed as my research will be followed up with similar resolution studies using this model and compared to my previous studies.

Poster 34

Presenter: James Mineau (University of Wisconsin - Madison)
Mentor: John Lin (Atmospheric Sciences)
Evaluating the Transport of CO2 in the Montane-Urban Region of Heber Valley

Greenhouse gases (GHG), such as carbon dioxide (CO_2), are primarily responsible for increases in global temperature. Since the industrial revolution, the human population has overwhelmingly been the cause of increased GHG emissions. As a result, cities are a significant source of GHGs to the atmosphere. In mountainous terrain, these emissions and other harmful particulates can become entrapped. While much research has been conducted on the transport of CO_2 and other particulates in the Salt Lake Valley, little effort has been dedicated to the nearby Heber Valley. This project addresses the lack of attention and evaluates CO_2 transport in Heber Valley, while asking "Is population growth effecting CO_2 trends significantly?" Heber and Salt Lake Valleys are strikingly distinct despite their geographic proximity. Understanding how differences in geophysical and socioeconomic attributes contribute to CO_2 concentration changes within their respective regions provide guidance for city planners and policy makers when developing municipal carbon emission plans.

This study contrasts the two valleys and conducts an exploratory analysis on CO_2 concentrations within Heber Valley. Human influences are assessed through changes in concentrations. Modelled biogenic and anthropogenic carbon fluxes are evaluated to determine relative contributions. Despite an almost doubling in population over the past two decades, there are no significant trends in excess CO_2 concentrations in Heber Valley. Yet, human influence is still observable through human constructed patterns such as the weekday-weekend as well as the Covid-19 pandemic. The Lagrangian Particle Dispersion Model, STILT, is utilized to identify direct source areas of concentration changes. Early results indicate that Heber Valley is characterized by large biogenic fluxes with little anthropogenic influence, suggesting that local anthropogenic emissions within relatively small cities are dominated by biogenic sources.

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Presenter: Linda Arterburn (State University of New York College of Environmental Science and Forestry)
Mentor: John Lin (Atmospheric Sciences)

Evaluation of CO_2 Emissions of Logan, Utah in Further Relation to the Cache Valley

The Utah Urban Carbon Dioxide Network [UUCON] is a network of long term stationary measurement sites that are used to measure CO_2 emissions throughout various different locations in Utah. Logan, Utah is a growing city in the Cache Valley that has been a part of the UUCON since 2015. With more people moving to Utah and progressions in technology, climate change, as well as biological factors, Logan's CO_2 emissions are destined to change year to year as well as season to season. Data analysis from 2015-2021 has revealed that CO_2 emissions in Logan, Utah have been increasing throughout the past six years. The data supports the idea that the increase in CO_2 emissions is linked more closely to biological processes than human interactions. Although the CO_2 emissions produced by humans is still a significant amount, the emissions produced by biological processes is of a larger quantity.

Poster 36

Presenter: Kody Hafen (Dixie State University)
Mentor: Jerry Cochran (Population Health Sciences)

Motivations for Recovery from OUD of Gestational Women

Objective - Pregnancy can be an optimal time for women seeking recovery because of additional motivating factors that can contribute to long-term recovery. Objective observations of motivations for recovery in gestational women with Opioid Use Disorder (OUD) can be observed by patients seeking medication-assisted therapy such as methadone or buprenorphine. This study will evaluate the subjective and expressed prevalence of gestational-related motivations in recovery from OUD.

Study Design - Sixteen recorded social work sessions in the OPTIMOM study were selected for a two-cycle coding method. In the first cycle, all sessions were listened to for identification of codes, the second cycle, two trained individuals coded all sessions. Selected codes related to independence, emotional or gestational driven motivations for recovery. Data collected from coding were interpreted to determine the prevalence of gestational motivations for recovery compared to other motivations for recovery.

Results - 48.2% of all references for motivations for recovery were related to the health, custody, and stability of children. References for fetal health, stability for children, and not losing custody of children were the first, second, and third most stated motivations respectively. 32.4% of all references were related to independence-related motivations, and 19.4% of all references were related to emotional related motivations.

Conclusion - With rising amounts of opioid use in pregnancy, there is an opportunity for more OB/GYN providers to treat OUD in pregnancy. The majority of expressed motivations for recovery of gestational women are related to the health, custody, and stability of children. Knowing that additional motivations are more frequently expressed for recovery from OUD in pregnancy, medical and mental health providers can be more cognoscente of the possible resources that women with OUD can use to achieve long-term recovery. Pregnancy can be an optimal time to aid gestational women in their recovery from OUD.

Poster 37

Presenter: Awais Ahmad (University of Utah)
Mentor: Owen Chan (Internal Medicine)

The Effect of Norepinephrine on Glutamate Release in the VMH during Hypoglycemia

Diabetes is a prevalent worldwide disease. Intensive treatment of type 1 diabetic (T1D) patients with insulin can minimize the development of long-term complications such as blindness, kidney failure, nerve damage and cardiovascular disease, but a common side effect is hypoglycemia or low blood sugars. About 3-4% of deaths in T1D patients are the direct result of hypoglycemia and therefore, it is important to understand the pathways that regulate the hormonal responses which protect against hypoglycemia - the "counterregulatory" responses. The brain and specifically, the ventromedial hypothalamus (VMH), plays an important role in detecting hypoglycemia and initiating the hormonal responses that counter the fall in blood glucose. Our research identified two brain signals, norepinephrine and glutamate, that initiate the counterregulatory responses to hypoglycemia, but it is unclear whether these two signals communicate with one another and this was the focus of the current study. To test this hypothesis, we infused either artificial extracellular fluid (Controls; n=4) or 400nM NE (n=4) into the VMH under normal glucose levels and evaluated its effects on the release of glutamate using microdialysis and the counterregulatory hormones in the plasma. The infusion of norepinephrine into the VMH caused a significant rise in plasma glucagon (Controls: 32.3±8.4 pg/mL, NE: 93.7±5.0 pg/mL; $P<0.001$) and epinephrine (Controls: 1195±313 pg/mL, NE: 8022±1873 pg/mL; $P<0.01$) levels. The increase in these hormones was associated with a slight increase in plasma glucose concentrations. Our data shows that the infusion of norepinephrine into the VMH triggers an increase in the counterregulatory hormone response and in turn, a rise in plasma glucose levels, suggesting norepinephrine is likely a major part of the central glucose sensing circuit that is involved in the initiation of the counterregulatory response to hypoglycemia.

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Presenter: Gisella Esparza (University of California, Berkeley)
Mentor: Swomitra Mohanty (Chemical Engineering)
mproving Detection of Tuberculosis Associated Volatile Organic Compounds in Breath via Hierarchical Nanostructured TiO2 Sensors and Improved Analyte Transport

In the year 2019 alone 1.4 million people died of tuberculosis. Tuberculosis is endemic to many developing countries and current methods of testing are invasive and inefficient. Contemporary studies have found that gaseous biomarkers known as volatile organic compounds (VOCs) in a patient's breath, specifically methyl nicotinate (MN), can be used to identify if a person has Tuberculosis. This provides an auspicious method of diagnosing patients in a fast and non-invasive manner. Our study focuses on two avenues of improving this process. One facet of this approach relies on increasing the mass transfer of a VOC in solution to use screen-printed electrodes (SPE's) already being made in the current market that are consistent, inexpensive, and regulated. This requires using an engineered electro-active soliton (EAS) and square wave voltammetry to create a baseline record of what MN detection looks like. This involves adjusting temperature, pressure, and other solubility factors when dissolving gas into an aqueous solution. The second direction aims to improve cobalt-functionalized titanium dioxide nanotube arrays (Co-TNA) sensors being synthesized through a three-step process of anodization, annealing, and functionalization. The breath sample is in contact with the surface of the sensor and cyclic voltammetry is used to detect the presence of MN. While this current sensor provides consistent results there is a suitable amount of variability on the surface of the sensor that can lead to inaccurate diagnosis. Double anodization may create greater consistency on the surface of the sensor through the nanotubes created in the anodization step allowing for cobalt to have a greater area to attach. It may also provide a more uniform area of contact between the sensor and clip used to run a voltage through it when testing a breath sample. Both of these techniques seek to improve the way gaseous biomarkers are used for the diagnosis of tuberculosis.

Poster 39

Presenter: Christain Norseth (University of Utah)
Mentor: Daniel Wik (Physics & Astronomy)
The Unseen: Clumping in the Outskirts of Galaxy Clusters

Galaxy clusters are the largest gravitationally bound structures in the known universe and contain hundreds to thousands of galaxies. They are important to study as their properties hold key information about large-scale structure formation, as

well as cosmology, which is concerned with how the universe formed and how it is evolving. We can study the Intra-Cluster-Medium (ICM), which is the hot gas (~10^7 K) that permeates the space between galaxies in a cluster. Due to Bremsstrahlung radiation, the ICM shines brightly in the X-ray range of light. Various properties of this gas can be extracted from observations of clusters, such as their density, temperature, and entropy as a function of radius from the central emission peak to the outskirts. An entropy profile is important because it can tell us how the cluster has evolved over time. Based on our current understanding, the entropy of the ICM is expected to increase outward from the center. However, observations show that in the outskirts, the entropy can drop off unexpectedly. A likely cause for this is gas clumping, where a clump of denser and cooler structure surrounds an individual galaxy. Since entropy depends on temperature and density, these clumps can have a large impact on the entropy profile as well as other derived profiles of a cluster. It is therefore important to be able to detect these clumps and correct for them. However, current telescopes are unable to see them. To solve this issue, a telescope called STAR-X will be proposed to the Mid-Sized Explorer Class Mission (MIDEX) call by NASA at the end of 2021. Due to its low altitude orbit, it will be sensitive enough to detect clumping. The aim of this work is to simulate observations of clumping in clusters to determine how well STAR-X will be able to detect clumps, as well as what clumping properties produce observed entropy profiles. This is achieved by using yt, pyXSIM, SOXS, and other tools to extract radial temperature and surface brightness profiles using concentric annuli and to compare them to observed data from other X-ray missions.

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Presenter: Devon Barros (Bridgewater State University)
Mentor: Binita Hona (Physics & Astronomy)
Unlocking the Mystery of Gamma-ray source TeV J2032+4130 using VERITAS data

TeV J2032+4130 is a high energy celestial object that emits Very High Energy (VHE) gamma rays, and is located in the star forming region of the Cygnus constellation. It was first detected by the High Energy Gamma Ray Astronomy (HEGRA) experiment, followed by the observation by other gamma-ray instruments such as MAGIC, WHIPPLE, VERITAS and HAWC. Later observations from the Very Energetic Radiation Imaging Telescope Array System (VERITAS) discovered that the gamma-ray emission from the source could be coming from a Pulsar Wind Nebula (PWN) powered by a binary pulsar named PSR J2032+4127. For the PWN scenario, VERITAS predicted a cutoff in the gamma-ray spectrum above 10 TeV. Using close to 33 hours of VERITAS data, I have analyzed this source with the help of an internal software named EventDisplay and reported the detection significance and spectral energy distribution. Further studies with additional data and particle modelling at the region will help us understand and clarify the nature of this source.

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Presenter: Ryan Chigogo (Bennnington College)
Mentor: Binita Hona (Physics & Astronomy)
Investigating the unknown gamma-ray source 3HWC J2006+341

An unidentified gamma-ray source 2HWC J2006+341 was discovered by the HAWC Observatory in the Cygnus region in the second HAWC catalog of the gamma-ray sources. A 2020 study using FermiLat data and HAWC data significantly detected 2HWC J2006+341 as an extended source with TeV emission. The nature of this source however remains unknown, and it is theorized to be either a Pulsar Wind Nebula (PWN), a TeV halo or a Supernova Remnant (SNR) Shell. This research is a follow up study of 2HWC J2006+341 to gain more insight on its nature and to explore the source morphology and spectrum with the additional data. The analysis of the HAWC data shows 2HWC J2006+341 to be an extended gamma-ray source with the best fit spectrum as a log parabola and the best fit morphology of a 2D symmetric Gaussian. Further studies with the optimized energy bins using HAWC data and a joint multiwavelength analysis of 2HWC J2006+341 using FermiLat and HAWC data are needed to better understand the nature of this source.

Poster 42

Presenter: Lensky Augustin (Colby College) **& Nicole Hoffmann** (Furman University)

Mentor: David Strayer (Psychology)
Assessment of Nature Imagery's Influence on Attention Restoration

In modern society, people are spending less time in nature and more time indoors. Living in urban areas limits our opportunities to interact with nature, preventing us from experiencing the theorized cognitive benefits of exposure to nature. Attention Restoration Theory (ART) posits that exposure to nature can restore cognitive resources that are depleted in everyday, urban environments. The present study used electroencephalography (EEG) to observe the error-related negativity (ERN), a neural component of event-related brain potentials (ERP), which provides a quantified measure of cognitive control ability. In this study, the ERN was elicited by a Flanker Task. Previous research found an increase in ERN amplitude on a 4-day camping trip, indicative of improved cognitive control. Since people are experiencing less opportunities to be in nature, the present study aimed to examine whether nature imagery elicits the same cognitive benefits as being immersed in nature. The present study used a within-subjects design where participants completed the Flanker Task three times approximately a week apart from each other while the EEG signal was recorded. At Sessions 1 and 3, participants stared at a wall for 10 minutes prior to the Flanker Task. At Session 2, participants viewed 10 minutes of nature imagery prior to the Flanker Task. We hypothesized that nature imagery would display similar findings to nature immersion with an increased ERN amplitude at Session 2. However, results from the linear mixed effects model indicated that nature imagery did not significantly influence the ERN amplitude ($\chi 2(2)=2.98$, $p=0.225$). These results suggest that there may be unique characteristics of immersion in nature that influence cognitive control ability that nature imagery lacks.

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Presenter: Visakha Ho (Carnegie Mellon University)
Mentor: Jeffrey Bates (Materials Science and Engineering)
Biodegradable Superabsorbent Polymers

Disposable hygiene products have a short active use life span from a few hours to about a full day and take about 500 years or longer to decompose. With the global industry of disposable hygiene products to be worth an estimated $90 billion, there is a large impact on the environment after the products' one-time use. In order to reduce the effects of the hygiene product pollution, developing a biodegradable Superabsorbent Polymer (SAP) would greatly reduce the problems associated with the landfill and water contamination. With absorption rates from a range of 7-13 times its weight, there are promising results with plant- and algae-derived materials to be able to replace pre-existing current non-biodegradable SAPs. Methods of synthesis include dehydration and esterification. Cross linking biodegradable materials has shown to create longer polymer chains that have hydrophilic properties.The biodegradable materials have also shown to be applicable in hydrogels and sustainable packaging.

Poster 44

Presenter: Mark Jareczek (Washington University in St. Louis)
Mentor: Gina Frey (Chemistry)
Understanding and Developing Learning Assistants (LAs) as Future STEM Leaders: Inclusion and Equity Mindset

Active learning and collaborative learning have long been established as effective teaching practices for engaging STEM undergraduates. The Learning Assistant (LA) model has been applied to many introductory STEM courses to facilitate active learning and discussion among students. In the LA model, LAs are undergraduate mentors that have previously taken the course in which they work and are trained through a formal pedagogy course. LAs facilitate active and collaborative learning by scaffolding discussions among cohorts of students during class activities. Past research has noted significant student benefit upon implementation of the LA model. However, a smaller body of research has explored the impacts being an LA has on the LAs themselves. n this study, we investigated the impact of the LA experience on the LAs' inclusive and equity mindedness, expert-like approaches, and perceived STEM confidence/social belonging: components of effective future STEM leaders. We distributed a pre- and post-semester survey to first semester

STEM LAs during the spring 2021 term addressing the aforementioned components. We found: (1) LA understanding of inclusion and equity fit and expanded a previously constructed best-practice framework for chemical educators to promote inclusion and equity, with varying degrees of complexity in responses; (2) in the context of their STEM field (e.g., chemistry), LAs social belonging predicted their confidence in their STEM-field skills; and (3) LAs showed no change over the semester in expert-like approaches as measured by CLASS survey results, with high variance in both pre- and post-scores. Implications for LA educators are discussed, and LAs can potentially help to build an inclusive and equitable course. This study suggests that the LA experience may be an avenue to train future STEM leaders.

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Presenter: Jasmine Aguilar Lopez (University of Utah)
Mentor: Charles R. Rogers (Family & Preventative Medicine)
Using Qualitative & Quantitative Methods to Reduce Colorectal and Endometrial Cancer Disparities in Utah & Beyond

A retrospective cross-sectional analysis using Commercial Driver Medical Exam(CDME) data was performed to determine the association between colorectal cancer(CRC) risk factors and CRC prevalence among Commercial Motor Vehicle(CMV) drivers(ages 21-85), after adjustment for age. Our hypothesis was that CMV drivers with poor health have a higher prevalence of CRC due to the confluence of CRC risk factors experienced by this population after adjusting for age. National survey data from January 1, 2005, to October 31, 2012, among CMV drivers in 48 states were examined. CRC prevalence was the primary outcome, while independent variables included demographics, body mass index, and concomitant medication conditions. The CDME does not have a question about CRC diagnosis, text recognition was used to identify terms in the CDME notes and comments. Next, the entire CDME was reviewed by two researchers to determine definite versus probable CRC diagnosis, blinded to all other data. Our team also identified 311 records by searching for the following terms: colon, rectum, cancer, colorectal, CRC, and polyp. Kruskal-Wallis tests were employed to analyze continuous variables; Fischer's exact tests to analyze categorical variables. Univariate and multivariable logistic regression was utilized to quantify the magnitude and direction of the association between our independent variables of interest and CRC prevalence. Odds ratio(OR) and 95% confidence intervals(95% CI) were adjusted in a multivariate logistic regression. Obesity(OR=4.28; 95% CI=1.28-14.29) and increasing age(OR=1.09 per year; 95% CI=1.06-1.12) were significantly associated with CRC prevalence. Truckers with 4+ concomitant medical conditions were significantly more likely to have CRC(OR=5.58; 95% CI=1.26 - 24.75). Our findings highlight mutable risk factors and represent an opportunity for intervention that may decrease CRC morbidity and mortality among CMV drivers-a unique population estimated to live up to 16 years less than the general male population.

Poster 46

Presenter: Belize Iteriteka (Bates College)
Mentor: Kristen Kwan (School of Biological Sciences)
Visualization of extracellular matrix proteins in corneal morphogenesis

The cornea, the outermost layer of the eye, protects and refracts light entering the eye, and malformations of the cornea can result in visual impairment. The cornea is composed of three tissue layers, the corneal epithelium, stroma, and endothelium. Although we know the embryonic origins of the corneal tissue layers, we do not understand the cellular and molecular mechanisms that control their formation. The extracellular matrix (ECM), a complex glycoprotein layer that includes collagens and laminins, plays crucial roles in morphogenesis, but the precise function of ECM proteins in the cornea is unclear. Using zebrafish embryos as a model, we can identify where and when specific ECM proteins are localized in the developing cornea (epithelium, stroma, and/or endothelium) by examining embryos at different developmental stages. Along with its rapid growth and human-like eye structure, the zebrafish is an ideal model for examining cornea assembly because the embryos of zebrafish are transparent and externally fertilized. Here we use antibody staining to detect ECM proteins including collagen types 2 and 4, and laminin. At 96 hpf and 102 hpf, collagen 4 and laminin expression were found in the lens capsule. Moreover, at all three stages (72, 96, and 102 hpf) collagen 2 and 4

expression was detected in the cornea, but no laminin expression was detected. Ultimately, this study is a first step towards determining the functional role of ECM molecules in corneal tissue assembly during embryonic development.

Poster 47

Presenter: Kalyn Fuelling (The University of Michigan)
Mentor: Michael Simpson (Materials Science and Engineering)
The Solubility of Mg in Molten Salts in Relation to Temperature for Use in Concentrating Solar Power Plants

Molten chloride salts are a promising option for heat transfer use in concentrating solar power plants due to their ability to transfer heat efficiently and remain stable at a variety of temperatures. However, these salts are corrosive and therefore break down pipes in the plant. In this study, the aim is to further investigate the solubility of magnesium in $MgCl_2$-KCl-NaCl salt to reduce the formation of corrosive hydroxide/oxide ions. Redox potential was used to indicate the dissolution of the magnesium in the molten chloride salts at different temperatures. A previous study reported that the addition of the magnesium to the $MgCl_2$-KCl-NaCl salt resulted in a lower redox potential than that of pure $MgCl_2$-KCl-NaCl. This study will focus on refining the relationship between the solubility of magnesium and operating temperature. Tests were conducted at 500°C, 600°C, and 650°C. With this data correlating to temperature, concentrating solar power plants can know precisely how much magnesium needs to be added to the molten chloride salt at a certain temperature in order to adequately lower the redox potential and thus result in a less corrosive substance.

Poster 48

Presenter: Freddy Luna (Dixie State University)
Mentor: Luisa Whittaker-Brooks (Chemistry)
Synthesis of TaSi2P4: A Theoretical Superconductor

Since the discovery of the superconductor, there has been an emphasis on synthesizing materials that behave as superconductors at relatively high temperatures and magnetic fields. A successful synthesis of a material exhibiting these properties would greatly improve electronics as superconducting materials use energy more efficiently relative to regular conducting and semiconducting materials. The following details several routes of synthesizing a monolayer of the material $\alpha_1 - TaSi_2P_4$, predicted to have superconducting properties in the monolayer regime at high temperatures. This material is expected to be a relatively high magnetic field superconductor since it theoretically exhibits Ising Bardeen-Cooper-Schrieffer (IBCS) and Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) paring mechanisms. Solid- and solution-phase chemistry approaches were used to develop a synthesis of $\alpha_1 - TaSi_2P_4$. The solid-state chemistry synthesis consisted of preparing a mixture of fine elemental powders of tantalum, silicon, tantalum disilicide, and phosphorus to be placed in a furnace in an evacuated ampule. The solution-phase chemistry route consisted of reacting tantalum ethoxide, silicon tetrachloride, and a phosphorus precursor in a variety of solvents. Analysis of the products obtained were done by X-ray Diffraction (XRD) and Energy-dispersive X-ray spectroscopy (EDS). Analysis by these techniques suggests that both methods may be in consideration for developing an effective synthesis. As yet, the successful synthesis of the theoretical superconductor $\alpha_1 - TaSi_2P_4$, is ongoing.

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Presenter: Lex Putnam (University of Utah)
Mentor: Matthew Basso (History)
A War on Many Fronts; Fighting Discrimination on the Homefront WWII Homefront Theme Study

Although there have been numerous theme studies written and commissioned by the National Park Service on the American WWII Homefront, many of these studies neglected to fully detail the struggles and efforts put forth by marginalized communities. The queer community, (only one of many that we are examining) for example, has largely remained undiscussed within the context of WWII. Moreover, the struggles faced by these groups varied largely. Women, while flocking to the workforce, had to contend with narratives around their appearance, as well as their role as mothers.

Black women, further faced difficulty in even acquiring these manufacturing jobs. Violent race riots broke out at the proposition of desegregating housing to accommodate upticks in population in urban centers. The Homefront effort was a battle on many fronts. Another, equally important aspect of this project, is the National Heritage Cities Project. We aim to help identify one city per 55 state and territories, that was particularly significant to the Homefront War effort. WWII led to massive upticks in production. At the conclusion of the war, many of these buildings, both factories, and relocation camps, were repurposed. As a result, they have lost the necessary integrity for NHL or National Register status. Natural deterioration over time has further contributed to urgency in identifying these locations-before it's too late.

Poster 50

Presenter: Eliza Pace (University of Utah)
Mentor: Kim Mangun (Communication)

High School Curriculum on Social Media and Mental Wellbeing: Combating the Negative Effects through Education and Application

Over the past ten years, there has been a significant rise of depression and suicide rates in adolescents. These rates coincide almost exactly with the rise in smartphone use and the development of social media. Evidence of multiple studies over the last twenty years suggests that social media plays a significant role in influencing these high depressive and subsequent suicide rates. Social networking sites are constantly evolving and yet school curriculums have not evolved to keep up with the changing conditions that adolescents encounter. Studies show that most teens use social media networks on a daily or even hourly basis and yet there are absolutely no resources available to teach adolescents any form of coping, safety, or appropriate online behavior. I have created a curriculum on social media and its effects on teens in a variety of area for grades 9-12. While there are a few existing programs of media literacy available for elementary school kids, there are no existing resources or educational materials for high school students. . A few specific programs exist for issues like pornography or suicide, however, there isn't one resource that is entirely comprehensive of these issues in regards to social media. This curriculum was made to be fully implemented to high school health classes and teaches not only research but application of best practices for positive social media use.

Poster 51

Presenter: Addison Billion (University at Buffalo)
Mentor: Martin Tristani-Firouzi (Pediatrics)

Nuclear Factor of Activated T-Cells (nfatc1) Regulation of Atrial Genes in Zebrafish

Familial atrial fibrillation (AF) is an inherited heart arrhythmia characterized by irregular and rapid atrial rhythm. It affects several members of the same family and has a young-onset presentation at <40 years old. We have identified a novel mutation (M527L) in the nuclear factor of activated T-cells, cytoplasmic 1 (NFATc1) that segregates in an autosomal dominant pattern within a family with a young-onset AF phenotype. Our preliminary data in silencing experiments of cultured atrial HL-1 cells showed the potassium channel KCNA5 and proteolipid SLN, which are differentially expressed in the atria and are essential for its function, appear to be affected by the loss of NFATc1. The purpose of this study is to determine if NFATc1 is involved in regulating the expression of atrial genes such as KCNA5 and SLN. To do this we will use atria from wildtype and knockout nfatc1 (nfatc1$^{-/-}$) zebrafish to determine the level of expression of kcna5 and sln. RNA will be extracted from atria, treated with DNase to remove genomic DNA and relative expression will be measured by qPCR. We will evaluate primer specificity by melting curve and agarose gel. Based on our previous findings, we expect to find a reduced expression of kcna5 and sln in nfatc1$^{-/-}$ atria. This would tell us that nfatc1 plays a role in regulation of the expression of these proteins in an animal model and allow us to better understand the mechanism behind familial AF, a first step to designing a treatment for AF.

Poster 52

Presenter: Kevin Ramos (University of Utah)
Mentor: Amanda Bakian (Psychology)

Relationship Between Suicide Prevalence and Land Surface Temperatures in Utah

According to the World Health Organization, approximately 800,000 people die by suicide annually. Suicide is often perceived to increase in cold and "gloomy" areas, but some research suggests the contrary. Suicide is most prevalent during the spring and summer months. Heatwaves are increasing in intensity and frequency. In this research, we explored the association between land surface temperatures (LST) during the summer months and suicide prevalence in the state of Utah.

Urban census tracts in West Valley and North Salt Lake have clusters of high suicide prevalence and high LST. Rural tracts in southcentral and eastern Utah have clusters of high suicide prevalence and high LST. Increases in green spaces in these areas could mitigate the adverse effects of high LST. Research on extreme heat and suicide is limited. These results will be utilized as a starting point for developing future hypotheses related to extreme surface temperatures and suicide prevalence in Utah. Increases in extreme heat events and their intensity could be linked to increases in suicide prevalence.

Poster 53

Presenter: Sonresa Ochoa-Vidales (University of Utah)
Mentor: Nels Elde (Human Genetics)
Evolutionary Analysis of Host-Pathogen Adaptations in MDA5

Host double-stranded RNA binding proteins (dsRBPs) can recognize double-stranded RNA (dsRNA) viral genomes, leading to host-protective immune responses. Genomic changes occur upon repeat encounters between host and pathogen proteins (host-pathogen arms race), impacting host protein function. We analyze adaptive genetic changes and use evidence of positive selection to identify specific dsRBP involvement in host-pathogen arms races. Our focus is on the dsRBP MDA5, which was shown to be positively selected when a diverse group of mammalian species was evaluated. We hypothesized that MDA5 is under positive selection in specific mammalian orders, and that we can identify specific amino acids under positive selection. If MDA5 is the basis of an evolutionary arms race between mammalian hosts and their viral pathogens, then we would expect strong evidence of positive selection in MDA5. To test our hypothesis, we aligned primate, bat, or rodent sequences from GenBank, then assessed positive selection using PAML (Phylogenetic Analysis by Maximum Likelihood). We found 5 amino acid residues under positive selection in primates, 1 in bats, and 3 in rodents. We observed positive selection for MDA5 in all three individual mammalian orders, supporting our hypothesis that an arms race may exist between mammalian hosts and dsRNA viruses. To extend and complement our evolutionary analyses, our next steps are to design experiments to assess the functional significance of the amino acid changes we observed across species, in order to generate hypotheses about how this positive selection might affect MDA5's ability to recognize and engage with dsRNA or other proteins.

Poster 54

Presenter: Shree Prakash (University of Utah)
Mentor: James Gagnon (School of Biological Sciences)
CRISPR perturbation of the gene regulatory network that specifies the zebrafish mesoderm

During early development, zebrafish cells undergo gastrulation, a process that establishes a cell's fate to develop one of the three germ layers: ectoderm, mesoderm, or endoderm. Signaling pathways and key transcription factors (TFs) initialize a gene regulatory network that specifies and diversifies mesoderm during gastrulation. Three TFs - *tbxta, tbx16,* and *noto* - are essential for the mesodermal gene regulatory network, affecting initiation and maintenance of mesoderm derivatives such as the notochord and tail bud. *tbxta*, *tbx16,* and *noto* regulate one another through a series of additive and antagonistic interactions during different stages of gastrulation. My objective is to characterize and understand how these three transcription factors work individually to specify different aspects of mesoderm, as well as to assess the presence of redundant or synergistic interactions that contribute to the overall gene regulatory network. I am generating mutants of *noto, tbxta,* and *tbx16* into zebrafish embryos using the CRISPR-Cas9 genome editing. I calibrated the CRISPR injections to yield the expected mutant phenotypes, then optimized an embryo dissociation protocol to yield a suspension of healthy

single cells from the mutant embryos. The dissociated cells are submitted to single-cell RNA sequencing (scRNA-seq) to obtain single-cell gene expression profiles for each mutant. I will compare mutants to control embryos and analyze the differences in cell type abundance and gene expression. The use of CRISPR-mediated mutagenesis with scRNA-seq will provide novel insights into how the interactions of *tbxta, noto, and tbx16* control the mesodermal gene regulatory network.

Poster 55

Presenter: Ashley Merrell (University of Utah)
Mentor: Gail Zasowski (Physics & Astronomy)
Understanding the Morphologies of Milky Way Analogs

Galaxies, like our Milky Way, are groups of stars (millions or billions of them) held together gravitationally. The perspective from which we observe galaxies plays a key part in the kinds of information we're able to learn about them. Our position inside of our own Milky Way Galaxy gives us a unique perspective.

While we are able to view our galaxy at smaller scales than are achievable for other galaxies, we struggle to measure some parameters that are quite easy to measure for other galaxies -- especially the details of its morphology (or its shape, including details like number of spiral arms and the light profile of its disk). From our point of view, it is difficult to observe galaxy structures through all of the obstructive dust that pervades the disk of the Milky Way and blocks much of the starlight. This, and since we are situated inside of the galaxy (giving us no way of viewing it from the outside), raise unique challenges when it comes to studying the characteristics of our galaxy's morphology. One powerful method to overcome this, and the goal of this research project, is to use galaxies that are similar to the Milky Way (called "analogs") to learn vicariously about the MW's hard-to-measure properties. We will analyze morphological properties of galaxies in multiple analog samples, each defined by different non-morphological properties of the Milky Way, using several catalogs from the Sloan Digital Sky Survey (SDSS) taken from the APOCHEE Point Observatory.

Preliminary results show that the Milky Way's smaller disk size makes it a remarkably compact spiral, compared to its analogs. Results show that Milky Way Analogs' disc scale lengths correlate with higher T-types, and find evidence to suggest that the Milky Way may be a red spiral.

Poster 56

Presenter: Jasiel Ramirez (Boise State University)
Mentor: Erin Castro (Educational Leadership & Policy)
Criminal and Disciplinary History Questions in College Admissions: A Mixed-Methods Analysis of Hispanic Serving Institutions

This research examines the inclusion and use of criminal and disciplinary history questions in undergraduate admissions among Hispanic Serving Institutions (HSIs). Although including questions about criminal and disciplinary history can be common within admissions applications, it is uncertain how frequent this practice is implemented and whether specific types of institutions are more likely to ask these questions. In order to better college pathways that support individuals with previous criminal histories at Hispanic Serving Institutions (HSIs), there must be an identification of any existing bias within the admissions process. By utilizing a mixed-methods approach, the data for this study includes a methodical review of admissions applications as well as interviews with and surveys distributed to admissions administrators among HSIs. By emphasizing the need for equity and the purpose of institutional responsibility, this research proposes that all higher education institutions should not require the disclosure of criminal and/or discipline histories.

Poster 57

Presenter: Ryan Gage (Southern Utah University)
Mentor: Lisa Joss-Moore (Pediatrics)
Effects of Pre- and Postnatal Growth Restriction on Expression of a Novel Splice Variant of PPARγ in Rat Lung

Preterm infants frequently suffer growth restriction, increasing the risk and severity of neonatal lung disease, characterized by impaired alveolar development and worse outcomes in male infants. We showed that growth restriction in the prenatal (IUGR) or postnatal (PGR) period reduces rat lung PPARγ gene expression, which results in impaired alveolar development. PPARγ variants, including the novel delta 5 splice variant (PPARγΔ5), can impact the downstream effects of PPARγ activation. As PPARγΔ5 is a dominant negative variant the effect of increasing PPARγΔ5 is a reduction in PPARγ signaling. Whether PPARγΔ5 is expressed in the rat lung or effected by growth restriction is unknown. We hypothesized that PPARγΔ5 will be expressed in rat lung, and that IUGR and PGR will alter expression. IUGR and PGR was generated by bilateral uterine artery ligation and variation in litter size in Sprague Dawley rats, and lungs were collected at postnatal day 12. PCR, gel electrophoresis, and sequencing were used to identify PPARγΔ5, and real-time RT PCR was used to assess PPARγΔ5 mRNA levels. PPARγΔ5 mRNA is expressed in rat lung at postnatal day 12, and the combination of IUGR and PGR increased PPARγΔ5 mRNA in male, but not female rat lung. We speculate that increased PPARγΔ5 expression in male IUGR+PGR rat lungs may further impair PPARγΔ5 signaling, leading to impaired alveolar development.

Poster 58

Presenter: Shelby Galinat (University of Utah)
Mentor: Matt Sigman (Chemistry)
Evaluating Bipyrimidines as Novel Electrophoto Reductants

Recently, the fields of electrochemistry and photochemistry have been combined as electro-photocatalysis (EPC), a promising technique for more efficient and sustainable synthesis. EPC has been investigated as a method for replacing strong chemical reductants, such as Na and Li metal, in common synthetic methods. This study explores the potential for a bipyrimidine electrochemical reductant to be further activated photochemically to enable new catalytic pathways. Variable conditions for a reductive borylation reaction are screened to analyze the role of the bipyrimidine catalyst. All reaction conditions yield reaction outcome, indicating that the bipyrimidine may act electrophotocatalytically to reductively borylate a substrate with a reduction potential of -2.26 V vs SCE.

Poster 59

Presenter: Cherokee Bodell (Indiana Institute of Technology)
Mentor: Joseph Yost (Neurobiology & Anatomy)
Optimization of nuclei isolation for downstream single nuclei ATACseq and Multiome ATAC + Gene Expression

Single nuclei genomic technologies have become a gold standard approach to characterize cell types and transition states while uncovering unknown molecular mechanisms and gene regulatory pathways in development and disease. Single-cell Multiomics allows researchers to simultaneously profile both gene expression and chromatin accessibility landscapes from individual cells.

Success in single nuclei genomic approaches is highly dependent on nuclei isolation protocols and their optimization. There are 4 main challenges during nuclei isolation: (1) yield, ~4000nuclei/◎l are required; (2) nuclei quality, differences in seconds in lysis steps greatly impact in nuclei quality; (3) each sample type needs its own protocol optimization; (4) data quality is unknown until experiment has been completed. The goal of this project is to test vendor-approved protocol vs. gradient-based nuclei isolation protocol (Frankenstein protocol by Luciano Martelotto) and assess sample yield and purity, nuclei integrity, protocol reliability and data quality.

Adult zebrafish hearts are dissected and used for cell dissociation and nuclei isolation. Nuclei integrity is assessed by inspecting sample in microscope at 60X Magnification. Sample quality is assessed with automated cell counter with Acridine Orange (AO) and Propidium Iodide (PI) staining. Sequencing and data quality is assessed with Cell Ranger.

Identifying a nuclei isolation protocol that best tackles the caveats of nuclei integrity and sample optimization will allow efficient, cost-effective and reliable single nuclei genomics analyses. The long-term goal is to provide Multiomics data from zebrafish hearts that have been altered by mutations or other experimental manipulations leading to heart disease and failure to regenerate.

Poster 60

Presenter: Faris Khan (University of Utah)
Mentor: Dmitry Bedrov (Materials Science and Engineering)
Computational Design of PFAS-Selective Materials for Water Purification

Perfluoroalkyl substances (PFAS) are fluorinated polymers that are used to manufacture a variety of consumer products, such as nonstick cookware, waterproof clothing, and stain-resistant carpets. PFAS pose significant health concerns, and because of their very high chemical stability, they do not break down in the environment. Perfluorooctanoic acid (PFOA) alone is linked to at least six human diseases, two of which are cancers. It contaminates the drinking water of more than 200 million Americans, and its lifetime health advisory is about the same as one drop in an Olympic-size swimming pool.

All PFAS exist at concentrations several orders of magnitude lower than typical, nonfluorinated contaminants, so current filtration materials get saturated before they can effectively remove PFAS from contaminated water. There is an urgent need for materials that can selectively capture PFAS. Developing these materials requires a deeper fundamental understanding of the functional groups that are selective to PFAS. Molecular dynamics (MD) simulations can be used to computationally analyze PFAS sequestration materials at the molecular scale to identify trends and streamline materials design.

In this project, an experimental system was simulated to analyze and evaluate a polymer gel that showed promise in the lab. The proposed ionic fluorogel reportedly relies on ion exchange and fluorophilic sorption for PFAS filtration. MD simulations were used to put these assumptions to the test. The simulated systems suggest that the mechanism for PFAS binding is more complex than initially proposed and that certain portions of the polymer gel's design may not be responsible for PFAS binding as previously believed. Future research will focus on simulating "what if" scenarios and making iterative changes to the material's design before performing experiments in the lab. This will allow the specific role of every chemical group to be well-understood so that PFAS-selective materials development is well-informed by molecular design.

Poster 61

Presenter: Pendeza Mulibea (Texas Christian University)
Mentor: Adriana Coletta (Health, Kinesiology, and Recreation)
Factors Influencing Engagement in Hospital-Based Exercise Oncology Programs

Exercise has tremendous benefits for cancer survivors. Across the board, survivors experience improved quality of life, and attenuation of treatment related side effects when engaging in exercise across the cancer care continuum.1 Exercise programs specific to cancer survivors may be one strategy to promote exercise engagement in this population. 2 It is beneficial for the program to be cancer-specific because programs offered by cancer centers and delivered by cancer exercise specialists, defined as hospital-based exercise oncology programs, is a salient reason for survivors participating in an exercise program. 3 We carried our review to evaluate evidence related to cancer survivors' experiences in hospital-based exercise oncology programs and understand the barriers, facilitators, preferences, and predictors surrounding participation.

Poster 62

Presenter: Shandra Payne (University of Utah)
Mentor: Valerie Vaughn (Internal Medicine)

The Impact of Pharmacist Perceptions of Respect on the Antimicrobial Prescribing Performance of Hospitals

Introduction
Antimicrobial resistance is a threat to our society. Prescribing antibiotics when they are not needed, or for excessive duration, leads to antibiotic resistance and patient harm from adverse events. Pharmacy plays a critical role in antibiotic stewardship in hospitals, often making recommendations on antibiotic changes to hospitalist physicians. We hypothesized that hospitals that better incorporate pharmacists in the clinical team could have better antibiotic use. Thus, we surveyed pharmacists at hospitals with different levels of appropriate antibiotic use at discharge to identify how pharmacists perceived they were respected and valued by other members of the clinical team.

Methods
In a previously published study, we quantified antibiotic overuse at discharge (Vaughn, 2020). From this study, we selected four diverse hospitals with variable rates of antibiotic overuse at discharge. At each hospital, clinical pharmacists who worked with hospital medicine teams received an online Redcap survey with three questions answered on a 5 point Likert scale (1=strongly disagree, 5=strongly agree): a) I am respected by my pharmacist colleagues, b) I am respected by my hospitalist colleagues, c) I am considered a valuable member of the clinical team. Scores at the lowest performing hospital were compared to the remaining hospitals using unpaired, two-sided t-tests.

Results
Survey response rate was excellent at 93% (22/24). Across all hospitals, reported ratings were high with most pharmacists agreeing or strongly agreeing that they were respected by pharmacists, respected by hospitalists, and valued members of the team. When compared to higher-performing hospitals, pharmacists at the lowest-performing hospital (hospital A) reported similar ratings of respect by other pharmacists (4.4, SD: 0.9 vs. 4.5, SD: 0.7, P=0.514) but statistically significantly lower respect by hospitalists (3.6, SD: 0.9 vs. 4.5, SD: 0.6, P=0.02) and reported lower agreement with being considered a valuable member of the clinical team (4.0, SD: 0 vs. 4.6, SD: 0.5, P=0.009).

Limitations
We were limited by a small pharmacist sample size, exclusion of hospitalist perspectives, and reliance on self-reporting. Strengths included ability to compare ratings based on antibiotic use measures and inclusion of diverse hospitals.

Conclusions
Pharmacists at the lowest performing hospital had significantly lower perceptions of whether they were respected by hospitalist physicians and considered valued members of the clinical team. Future steps include validation of findings in a larger cohort and qualitative methods to explore why pharmacists might feel undervalued at lower performing hospitals. These findings suggest that poorer teamwork and inclusion of pharmacists in antibiotic stewardship could partially explain lower hospital performance in antibiotic stewardship.

Poster 63

Presenter: Vincent He (University of California, Santa Barbara)
Mentor: York Smith (Metallurgical Engineering)
Extraction of Lithium From Salt Lake Brine

Lithium is used extensively in our daily lives ranges from personal electronics to electric vehicles. The supply of lithium is crucial to industries and people benefit from lithium-ion batteries. Without lithium, phones will not turn on and electric vehicles will not run on the street. Even lithium reserve is abundant compare to other metals needed to make batteries, they exist in many different forms which makes them difficult to extract. The common way now to obtain lithium is from mines. But for places without mines, it will be difficult to supply a sufficient supply of lithium to support industries. However, lithium is also found in salt lake brine in ion form. But extracting lithium from brine is still challenging without appropriate material. Titanic acid was found to be a good brine sieve material that can be used for lithium extraction. It can be obtained by delithiating lithium titanium oxide. This material was found to have higher adsorption than materials

used for lithium extraction. The extraction can be as simple as putting the material into the brine. This creates an energy-efficient and environment-friendly way to extract lithium from salt lake brine.

Poster 64

Presenter: Toby McMurray (Southern Utah University)
Mentor: Jeffrey Bates (Materials Science and Engineering)
Developing a Biodegradable Pressure Sensitive Adhesive for use in Packaging

About one third of every landfill is made up of packaging materials. Among these materials is packaging tape which takes hundreds of years to degrade, causing lasting damage to the environment. The problem is that there are no biodegradable adhesives on the market that can be manufactured and perform at the industries' standards. Thus, to combat this, the goal of this research is to create a biodegradable adhesive that can be manufactured and perform like the current adhesives being used. To do this we are combining a variety of petroleum/plant-based materials including those with elastic, tacky, and plastic properties. We have been able to produce samples with viscous and tacky nature, though none being comparable to that of the standard adhesive. At 120°C the standard adhesive has a viscosity of 2600 mPa. The highest viscosity that one of our samples exhibited was 285 mPa. At 25°C the standard adhesive has a resistive force of 79.33 N. The highest resistive force that one of our samples exhibited was 30.00 N. These properties can further be optimized to match that of the standard adhesives by using different compositions and weight percentages. The biodegradation of the samples needs to be tested over a 6-month period, though, we would expect them to be biodegradable since they were made from biodegradable components.

Poster 65

Presenter: Chanel Van Ginkel (University of Utah)
Mentor: Roseanne Warren (Mechanical Engineering)
Flash Pyrolysis of Coal Char for Sodium-Ion Batteries

One great obstacle in creating a world where renewable energy is our primary source of power is efficiently storing the energy harvested from renewable sources. Advancing battery technology is pivotal in making renewable energy a sustainable alternative to current energy production methods. The problems with commonly used lithium-ion batteries are that they are expensive and limited in resources. Sodium-ion batteries (SIBs) provide a promising alternative because they are more cost effective and materially abundant. Due to elemental differences between sodium and lithium, sodium ions batteries are yet to perform as well as LIBs. The goal of our research is to develop competitively performing sodium-ion batteries using widely abundant coal char as the hard carbon anode material to lower cost per kWh of energy storage. Coal char's performance in batteries can be improved upon by manufacturing a highly porous carbon structure. Increasing the porosity of the coal char increases the surface area on the coal char particles which improves the energy storage potential within a battery. One way this can be done is by using flash pyrolysis to rapidly heat the coal. Flash pyrolyzing coal char particles (75-90 μm) at a heating rate of approximately (1400 K/s) to 900 C burns off unwanted volatile material leaving behind highly porous char due to rapid expansion. In three-electrode test cells, the flash pyrolyzed coal char electrodes show a low initial capacitance followed by an increase in capacitance in subsequent cyclic voltammetry tests. Which suggests that more testing needs to be done in order to confirm results and fully understand the properties of the flash pyrolyzed coal as an anode material.

Poster 66

Presenter: Aruna Dhungel (University of Utah)
Mentor: Jeffery Bates (Materials Science and Engineering)
Development of biodegradable, biopolymer-based materials for use in menstrual hygiene products

Most feminine hygrine products (FHP) in the market are made with synthetic materials and chemical additives which can take 450-1000 years to decompose. Exposure to chemical additives like BPA, dioxins, and petrochemicals also have

negative health consequences. While some companies have sought to create more environmentally and health-friendly FHP, their product contains certain components that are not biodegradable.
A pad is composed of four layers: 1: Top sheet, which is a fluid-permeable layer, it is used to draw the fluid away from the body; 2) the transfer layer which is the first initial absorbent layer; 3) the super absorbent core where most of the blood absorption takes place; 4) hydrophobic layer, which prevents leakage and helps the positioning adhesive adhere to the surface of undergarment.
This project aimed to find and test biodegradable materials for the transfer and hydrophobic layer. It also sought to examine the absorbency under load of the superabsorbent core (SAP) material. The results indicated that Material A was superior absorbent than Material B for the transfer layer. It also showed that there isn't a large difference between 5%, 10%, and 25% SAP combination with Material A. It was also discovered that materials like NVS, NK, and biobag do not behave ideally under high-temperature conditions making it harder to incorporate them as the ideal hydrophobic layer. The absorbency under load test showed that there was water loss after a force was applied to the core material. There were no notable differences observed between the 0% and 10% SAP in the absorbency under load test.

Poster 67

Presenter: Madison Parrot (California Polytechnic State University, San Luis Obispo)
Mentor: Jindrich Kopecek (Pharmaceutics & Pharmaceutical Chemistry)
A Novel Antibody-Polymer-Drug-Conjugate for the Treatment of Multiple Myeloma

Multiple myeloma (MM) is an incurable hematological malignancy with a five-year survival rate of 53.9% and 12,830 annual deaths. The treatment paradigm for MM underwent significant evolution in the last decade, nevertheless, MM remains incurable in the vast majority of cases. The overall objective of this project is to develop a novel antibody-drug conjugate consisting Daratumumab (DARA), an FDA approved anti-CD38 antibody, and multiple copies of GDC-0980, a PI3K/mTOR dual inhibitor, for the treatment of MM with promising enhanced efficacy and great translational potential. The conjugate design is based on robust technology ¾polymer-enhanced multiple payload antibody-drug conjugates (pADC)s.

The construct is based on a conjugate of DARA with semitelechelic (ST) N-(2-hydroxypropyl) methacrylamide (HPMA) - GDC-0980 conjugate. The inhibitor is bound to the copolymer via a degradable GFLG oligopeptide sequence stable in the blood stream and susceptible to cathepsin B catalyzed cleavage in the lysosomes. This class of antibody-drug conjugates, (pADC)s, can deliver a large "payload" of chemotherapeutics to a tumor with a high degree of specificity to increase treatment effectiveness while reducing side effects caused by off-target binding and eliminates the need to use highly potent cytotoxic agents.

During the last seven weeks a polymerizable GDC-0980 derivative, MA-GFLG-(GDC-0980), was synthesized, purified, and analyzed. Fluorescently labeled pADCs were synthesized and evaluation of their biological properties commenced. Binding specificity was validated in vivo in NOD/SCID mice employing the In Vivo Imaging System (IVIS). pADC strongly accumulated in CD38 positive RPMI tumor. Additional biological evaluation is planned as shown on the poster.

Poster 68

Presenter: Chloe Kraft (University of Utah)
Mentor: Maria Bettini (Pathology)
Primary T Cells Transduced with Insulin Specific TCRs Have Functional TCR Signaling Following Tetramer Stimulation

Type 1 diabetes (T1D) is an autoimmune form of diabetes which results from an adaptive immune response against islet self-antigens in the pancreas. T1D is an organ-specific autoimmune disease where T and B lymphocytes recognize islet antigens and subsequently destroy insulin producing beta cells. The body has multiple defense mechanisms to protect against autoimmunity, such as T regulatory cells (Tregs), a subset of CD4 T lymphocytes. Tregs have multiple suppressive functions, such as the production of immunosuppressive cytokines, which are regulated through signaling by T cell

receptors (TCRs). TCRs are protein complexes present on T cells that recognize antigens presented by major histocompatibility complexes (MHCs), and when activated propagate signals to the T cell. In T1D, these TCRs have the potential to respond to insulin antigens produced by beta cells, which are taken up by antigen presenting cells (APCs) and presented to CD4 T cells. CD4 T cells then activate macrophages, other CD4 and CD8 cells, finally leading to the destruction of beta cells. A hypothesized treatment for T1D involves improving trafficking of peripheral Tregs to the pancreas through modification of their TCR. This approach requires investigation into TCR affinity and downstream signaling processes. In this project, two insulin specific TCR vectors 12-4.4m1 and 4-8, with low and high affinities respectively, were used to transduce CD4 T cells from NOD Nur77-GFP mice, and their TCR signaling strength and function were examined. We hypothesized that both the low and high affinity TCR vectors will show functional TCR signaling, however the lower affinity TCR 12-4.4m1 will have a lower level of TCR signaling compared to the higher affinity TCR 4-8. Based on Nur77-GFP expression, we demonstrate that TCR signaling is active in these transduced T cells. Additionally, we show a higher level of Nur77-GFP expression in 4-8 transduced T cells compared to 12-4.4m1, which confirms the hypothesis that 4-8 induces higher TCR signaling in transduced T cells than 12-4.4m1 following tetramer stimulation.

Poster 69

Presenter: Deja Gaston (University of Utah)
Mentor: Amanda Bakian (Psychiatry)
"Testing for correlations between Toxic Release Inventory exposure and suicide prevalence in Utah using spatial analysis"

Increased suicide risk among adults have included multiple risk factors such as familial genealogy, socioeconomic and cultural derivatives. Recent studies have suggested a possible correlation between the change in exposure of physical environmental factors (e.g., increased land surface temperature and change in air pollution levels) and the increased prevalence of suicide. This research project used Toxic Release Inventory (TRI) facility data: a resource for learning about toxic chemical releases and pollution prevention activities reported by industrial and federal facilities. Two exposure variables were used: (1) counts of TRI facilities per census tract, and (2) total pounds of emissions released into the air from TRI facilities per census tract. We conducted bivariate correlations between the two exposure variables and suicide prevalence per 100,000 persons by collecting TRI facility data for the state of Utah (2007-2019), and geocoded residential address of suicides from 2013-2019 to derive the total number of suicides. The number of facilities as well as the total pounds of emissions from those facilities were summed together for the years 2007-2019 for all census tracts in Utah. In our results, we found that the amount of TRI facilities and suicide per 100,000 persons displayed higher significance of association than air emissions from TRI facilities. Bivariate analyses for both exposure variables revealed high cluster results most commonly in Salt Lake County. This study tested correlations (or associations) in the presence of TRI facilities, air emitted from TRI sites, and suicide prevalence. Results suggest a need for broader analyses of environmental exposure and its relationship with suicide prevalence in Utah. Multivariable analysis should be explored to consider confounding in the relationship between exposure to TRI sites and suicide prevalence. Future analyses may also consider the toxicity of specific chemicals and how that may influence suicide risk.

Poster 70

Presenter: Clara Lindley (University of Utah)
Mentor: Jennifer Ose (School of Biological Sciences)
Associations between inflammation and angiogenesis biomarkers and cancer-related distress: Results from the ColoCare Study

BACKGROUND
Patients with colorectal cancer are likely to suffer from distress including depression and anxiety as a result of the disease process. This distress may be also linked to systemic inflammation and angiogenesis. We investigated associations between inflammation and angiogenesis biomarkers and cancer-related distress 12 months after surgery in a prospectively followed cohort of colorectal cancer patients.

METHODS
We included n=315 colorectal cancer patients (stage I-IV) from two study sites of the prospective ColoCare Study: Huntsman Cancer Institute (HCI, USA) and University of Heidelberg German Cancer Research Center (DKFZ; HD, Germany). Serum samples were utilized to measure CRP, IL-6, IL-8, SAA, TNF-α, VEGF-A, VEGF-D, sICAM-1, and sVCAM-1. Distress was measured using the Cancer and Treatment Distress (CTXD) instrument focusing on 4 subdomains hypothesized to be associated with increased distress: uncertainty, health burden, family and friends strain, and managing medical and financial demands. Pearson's partial correlations were used to evaluate the association between log2-transformed biomarkers and distress, adjusting for age, sex, BMI, tumor stage, and study site.

RESULTS
We observed statistically significant associations between several biomarkers and subdomains of the CTXD measure. CRP, sICAM-1 and IL-6 were positively correlated with "family and friends strain". The corresponding correlations ranged between r= 0.19 (p=0.04, with CRP and sICAM-1) to r=0.22 (p=0.01 with IL-6). The other biomarkers were not significantly associated with any of the other subdomains or the overall CTXD score.

CONCLUSIONS
There is some evidence that inflammation and angiogenesis biomarkers are positively correlated with cancer-related distress one year after surgery. Interventions focused on family and caregiver relationships may have an impact on systemic inflammation and improve the quality of life of colorectal cancer patients. Further investigations are needed to determine whether biomarkers measured at baseline predict distress one year after surgery.

Poster 71

Presenter: Kennedy Chastang (Howard University)
Mentor: Marshall Roedel (Pathology)
Understanding Immunological Determinants and Outcomes in P. Falciparum-Astrocyte Interactions

Malaria is a disease transmitted by mosquitos and caused upon infection with parasites of the species *Plasmodium*. Though not currently transmitted in the U.S, malaria remains a severe global health issue that plagues regions such as Sub-Saharan Africa. With cerebral malaria being a serious complication most often found in children, it is important that the pathophysiology of *Plasmodium* infection in the brain be understood to design novel therapeutics for this condition. The Blood brain-barrier (BBB) is part of the neurovascular unit (NVU) and is made up of endothelial cells, pericytes and astrocytes. Characterized by the breakdown of this barrier, cerebral malaria occurs when *Plasmodium* infected red blood cells (iRBCs) attach to endothelial cell walls leading to a down regulation of tight junctions. The cause of this disruption is unclear. A key player in the BBB, little is known about astrocytes in cerebral malaria, but their relationship with endothelial cells, and their loss of maintenance of endothelial cell tight junctions under inflammatory conditions make them potentially critical in BBB breakdown in cerebral malaria. The early appearance of inflammatory proteins post-infection, such as the cytokine interferon-gamma, has been correlated with protection of clinical malaria symptoms. However, high numbers of interferon-gamma producing T-cells in the CNS are correlated with barrier breakdown. To further understand the role of astrocytes and inflammatory cytokines in cerebral malaria, we cultured an astrocyte cell line with inflammatory cytokines and iRBCs to create a simplistic model of *Plasmodium*-astrocyte interactions and to determine how astrocytes respond to parasite-induced inflammation. Flow cytometry was used to determine what proteins were expressed on NVU cell surfaces, in particular interferon receptors. Additionally, the validity of the C57Bl/6J mouse infected with *Plasmodium berghei* ANKA was shown to be a suitable mouse model for experimental cerebral malaria in future experiments.

Poster 72

Presenter: Gladwin Bryan Labrague (Missouri University of Science and Technology)
Mentor: Ilya Zharov (Chemistry)
Functionalized Mesoporous Silica Nanoparticles by Co-condensation

Mesoporous silica nanoparticles (MSNPs) are particles of nanoscale diameter that contain pores of 2-50 nm size. MSNPs have been widely used for drug delivery because they are biocompatible, have high surface area, and have tunable particle diameter and pore size. However, there is limited information regarding the preparation of MSNPs containing functional groups that are introduced during co-condensation, as opposed to the surface modification. Co-condensation is a simpler and more practical method as it requires fewer steps to perform and fewer reagents to use. This study aims to morphologically analyze functionalized MSNPs prepared by co-condensation under different reaction conditions. The functionalized MSNPs were synthesized using a modified Stober method and were analyzed using TEM. The micrographs showed that functional groups in the silica precursors affect the colloidal stabilization of MSNPs by increasing or decreasing hydrolysis/condensation rates due to steric effects, electronic effects, and the molecules' internal configurations. It was observed that the bigger the differences between the hydrolysis/condensation rates of the main and co-precursor silica sources, the more byproducts are formed. The interactions between the functional groups also appear to affect the formation of functionalized MSNPs.

Poster 73

Presenter: Jose Carreon-Andrade (University of Utah)
Mentor: Casey Mullen (Sociology)
How Participatory Air Quality Sensing Shapes Participants' Exposure Experiences: Connecting Indoor Sensor Data and Participant Observations

This project looks at how participatory air quality sensing shapes participances exposure experiences. Students built 11 Plantower particulate matter sensors and distributed them to 7 households after pre-interviews were completed. PMS data was collected weekly for a total of four weeks and converted into visualizations which were presented to participants during post-interviews. Preliminary findings showed that outdoor particulate matter pollution impacts indoor air quality negatively as supported by local research (Hegde et al. 2020; Mendoza et al. 2021). Further analysis will compare survey and post interview data with PMS data to assess patterns across participants perception and actions. Legislators should consider implementing steps to reduce outdoor air pollution and create policies that enhance equitable access to indoor air quality sensors to all households.

Poster 74

Presenter: Yousuf Haidari (University of Utah)
Mentor: Nicola Camp (Internal Medicine)
Multiple Myeloma Tumor Gene Expression to Predict Clinical Outcomes

Multiple myeloma (MM) is a malignancy of plasma cells in the bone marrow and one of the more common hematological malignancies (6.3/100,000 new cases/year). Incidence continues to increase (0.8% each year), and although treatments have improved, most patients do not survive beyond 5 years. Identifying high-risk groups is a critical need. SPECTRA is a promising new statistical technique to characterize global gene expression (the transcriptome) of a tumor by representing it as multiple quantitative tumor dimensions. Dimensions can be used in prediction modeling to identify high and low-risk groups.

Publicly available transcriptome data from 768 patients in the international CoMMpass study, 39 MM spectra were derived. Each patient has a unique spectra profile (or spectra "barcode"); patients can be compared by every bar in the barcode. Prediction modeling using spectra identified risk groups for survival and risk groups for time to treatment failure. In this way, a patient's tumor transcriptome can be used predict whether they are at high-risk to die sooner, or and have their treatment fail earlier.

To replicate the CoMMpass data findings, we are collecting and processing local biological samples from MM patients at the Huntsman Cancer Hospital. We collect bone marrow, whole blood and/or saliva. The bone marrow is cell-sorted to

identify tumor (CD138+) cells. RNA is extracted from these cells and sequenced to generate transcriptome data. Then the spectra barcode is calculated. Whole blood or saliva is used to extract normal DNA.

The quantitative SPECTRA technique provides a more complete understanding of MM by better characterizing the tumor. Each spectrum is a tumor characteristic. Our future research will include investigation of whether inherited variations (in normal DNA) are linked to risk of particular characteristics of MM toward early detection and prevention efforts. We are also pursuing the SPECTRA technique in several other cancers.

Poster 75

Presenter: Nathan Friede (Pomona College)
Mentor: Josh Tang (Chemistry)
Electroanalytical Characterization and Reactions of Nickel-Phosphine Complexes

First row transition metals have drawn great interest in modern catalysis due to their large abundance and decreased toxicity compared to the second and third row transition metals. Reports of cross-coupling reactions of aliphatic halides catalyzed by first group transition metal complexes have spiked in the past decade, demonstrated with reactivity and scope beyond noble metal catalysis. However, mechanistic knowledge of catalyst-initiated carbon-halogen bond activation is still underdeveloped for first-row transition metals as a consequence of the difficulties associated with isolating and characterizing the transient but essential intermediates involved in the catalytic cycle. The gap between reaction development and mechanistic understanding prevents a rational design of next-generation catalysts with enhanced reactivity and selectivity. Herein, we investigated into the carbon-halogen bond activation mechanism by three Nickel complexes bearing ligands from three unique classes of bidentate phosphine ligands. Key kinetic data obtained from the electroanalytical technique allowed us to examine the mechanistic pattern of the reaction between Nickel(I) complexes and over 30 benzyl bromides, which was then analyzed by multivariate linear-regression study with DFT-computed molecular descriptors. The descriptors in our models suggested a halogen atom abstraction mechanism, consistent with other physical organic analysis we conducted including Hammett studies. The insights gleaned from these studies led to a rational design of various synthetic transformations with promising reactivities, as is supported by our preliminary results.

Poster 76

Presenter: Raven Mingo (University of Utah)
Mentor: Michelle Schober (Health, Kinesiology, and Recreation)
Neurological Manifestations of COVID-19 in Pediatric Patients

Nearly a third of adults with COVID-19 experience neurologic dysfunction of the central and/or peripheral nervous systems during and after acute infection, but little is known in children. Our objective is to help characterize acute neurologic dysfunction associated with COVID-19 in children and its long-term effects on pediatric mental, emotional and functional health.

This is an observational retrospective and prospective study of pediatric patients who tested positive for COVID 19 and required hospital admission between January 1, 2020 and June 1, 2021. We will study acute manifestations directly from the electronic medical record using an IRB-approved waiver of informed consent. We will collect survey data on long-term neurologic manifestations after obtaining informed consent.

IRB-approved data collection from the electronic medical record and the mailing of letters to inform parents about future information for consent is ongoing. Once IRB amendment is approved, we will guide consenting parents/patients to complete the surveys and use a web-based link to share the electronic medical record data and survey results with a data coordinating center.

We anticipate that hospital and survey data will help characterize neurologic manifestations associated with COVID-19 in children. I have learned about many aspects of clinical study design and conduct. I anticipate helping with the data sharing portion of the study once IRB amendment is approved. I am compiling a list of interested parents and their contact information that will facilitate the informed consent process.

Poster 77

Presenter: Mansoor Mansoor (University of Utah)
Mentor: Justin English (Chemistry)
Developing a Method of RNA Recovery Unaffected by VEGAS Mutation

Directed evolution is an important tool in molecular biology, allowing researchers to alter and design proteins and overall bring the evolution process into the lab and accelerate it. A new method of directed evolution invented in the English lab called VEGAS (viral evolution of genetically actuating sequences) allows for directed evolution of proteins for desired functions in mammalian cells. VEGAS is performed using the Alphavirus Sindbis. The system is highly mutagenic, facile, and self-contained, requiring no *in vitro* handling during evolution cycles. However, while VEGAS is highly mutagenic, a limitation of using Sindbis virus is our inherent inability to fully capture and sequence all viral RNA genomes from evolutionary rounds in VEGAS. To solve this problem, we worked to develop a method of RNA recovery that is unaffected by sequence evolution. Our method is to synthesize a molecular handle to the viral RNA molecules to standardize sequence amplification of the viral RNA. We are using poly(A) polymerase, an enzyme that polyadenylates the 3' end of a nascent pre-mRNA transcripts in organisms, to apply the same modifications to our viral RNA. We first created a control construct by creating pTSin-eGFP Δ PolyA as the positive control and pTSin-eGFP as the negative control. Then, we performed in-vitro-transcription on these plasmids to generate the RNA version, after which we did Poly (A) Addition and Reverse transcript with a specific primer sequence. Before we checked for products, we completed a Polymerase Chain Reaction (PCR) to verify that the primers we were using worked. Having proving that the primers worked, successfully building the tool to demonstrate efficient poly adenylation, and successfully demonstrating that the poly Adenylase has a primer landing site that can be used for RT-PCR, we tested for the Effect of Poly Adenylation reaction duration on RNA Recovery. This is important because having a method of RNA recovery unaffected by sequences evolution will allow us to sequence and read anything that the virus mutates or produces.

Poster 78

Presenter: Jaxon George (Dixie State University)
Mentor: Hamid Ghandehari (Pharmaceutics & Pharmaceutical Chemistry)
Liposomal drug delivery in chronic rhinosinusitis

Chronic rhinosinusitis is a debilitating inflammatory disease of the sinuses and nasal cavity that affects ~13-15% of the United States population. Chronic rhinosinusitis has many etiologies, including bacterial, viral and fungal infections and even air pollution; CRS is characterized by CRS with and without nasal polyps (CRSwNP & CRSsNP), and both have relatively different pathophysiology. CRSwNP has TH2 driven inflammation and CRSsNP has TH1 driven inflammation. CRS patients experience epithelial layer degradation, reduced mucociliary clearance, and infection and inflammation of nasal mucosa resulting in chronic inflammation. Current treatment methods for chronic rhinosinusitis depend mainly on saline rinse, intranasal corticosteroid sprays, oral corticosteroids and antibiotics, and endoscopic sinus surgery. However, most of these treatment options lack in effectiveness and possess some serious short and long-term side effects, including slow wound healing, diabetes, adrenal suppression, and osteoporosis; thus, a more effective and targeted drug delivery system is necessary to properly treat patients with CRS. Liposomal drug delivery possesses promising capabilities as a drug delivery treatment option, as liposomes are capable of encapsulating both lipophilic and hydrophilic drugs into their lamella. The aim of this research project is to successfully synthesize liposomes that are both uniform, stable, and non-toxic and capable of encapsulating budesonide into the bilayer. If successfully incorporated, it is hypothesized that liposomal budesonide could reduce the inflammation by extravasating through the leaky vasculature of CRS patients and accumulate at the target site of inflammation.

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Presenter: Jakeline Larios (University of California, Los Angeles (UCLA))
Mentor: Corey Cunningham (Biochemistry)
Investigating Mitochondrial Heterogeneity via Intracellular Organelle Contacts

Mitochondria are the primary organelle that participates in essential metabolic processes such as the TCA cycle, the electron transport chain, and beta-oxidation. Recent discoveries found the presence of different subpopulations of mitochondria which exhibit distinct metabolic functions within a given cell. However, the underlying mechanisms that exist to promote mitochondrial heterogeneity remain ambiguous. We aim to further investigate intracellular mitochondrial heterogeneity establishment and maintenance in relation to proximity to other organelles such as: the golgi apparatus, lipid droplets, lysosomes, peroxisomes, endosomes, endoplasmic reticulum, plasma membrane, stress granules, and primary cilia (PC). We hypothesize that mitochondrial subpopulations proximal to organelles express distinct proteomes which allow the mitochondria to exhibit specialized metabolic functions. To accomplish this, we created a dual purification scheme which intracellularly labels mitochondria based on their spatial positioning in the cell using the APEX2 biotinylation system in combination with an elutable affinity purification of mitochondria labeled with a 8X His-Omp25 construct. We optimized the APEX2 biotin-phenol labeling of mitochondria to prevent high basal biotinylation and then conducted labeling at 5 seconds, 15 seconds, 30 seconds, and 1 minute. This was followed by His-Tag affinity purification, imidazole elutions, and re-purification of the biotinylated mitochondria using streptavidin beads. Isolated subpopulations of mitochondria proximal to a given organelle are then analyzed using quantitative TMT mass spectrometry to determine differences in mitochondrial proteomes. Through my analysis of mitochondrial intracellular interactions with PC, I anticipate that subpopulations of mitochondria in proximity to PC will develop distinct proteomes which further allow for specialized metabolic functions.

Poster 80

Presenter: Angela Pham (University of Utah)
Mentor: Monika Lohani (Educational Psychology)
Suicide Ideation: Psychological Determinants and Treatment

Introduction: Suicide ideation includes a range of thoughts, wishes, or contemplations about committing suicide. Approximately 10 million Americans struggle with suicide ideation, and suicide is the 11thleading cause of death in the United States. In the absence of an intervention, one-third of individuals with suicide ideation may attempt suicide within the first year of experiencing suicide ideation. Elevated stressful experiences can heighten suicide ideation. In addition, emotion dysregulation may further contribute to the emergence of suicide ideation in high-stress contexts. The current study investigated how emotion dysregulation may explain the relationship between stressful experiences and suicide ideation. We predicted that emotion dysregulation would mediate the positive association between three stress-related risk factors -stress exposure, perceived stress, and negative affect.

Method: A sample of 3929 participants reported their levels of suicide ideation (via the Beck Suicidal Intent Scale), emotional dysregulation (via the Difficulties in Emotional Regulation Scale), stress exposure (via the Holmes-Rahe Stress Inventory), and perceived stress (via the Perceived Stress Scale), and negative affect (via the Negative Affect Scale).

Results: Emotion dysregulation significantly mediated the positive relationships between suicide ideation and stress exposure ($p < 0.001$), perceived stress ($p < 0.001$), and negative affect ($p < 0.001$).

Discussion: The current findings highlight the importance of targeting emotion regulation skills in suicide prevention treatments. Timely intervention may help identify personal warning signs and adopt coping strategies to manage emotional dysregulation. Our lab's ongoing work explores the refinement of a suicide risk management intervention to teach effective emotion regulation that may reduce suicide ideation and attempts.

Poster 81

Presenter: Acaysha Jones (Salt Lake Community College)
Mentor: Joanna Grudziak (Surgery)

Feasibility of collecting baseline patient-reported outcomes in emergency surgery patients in correlation to next of kin

Introduction: Trauma and emergency general surgery patients admitted to the surgical intensive care unit suffer long term declines in their overall function. Little is known regarding patient reported outcomes (PROMs) in this patient population. The PROMIS framework, developed and endorsed by the NIH, is a promising tool for collecting PROMs, and has been validated in many populations. Currently no study using PROMIS in trauma or EGS patients in the ICU exists. Our aim was to evaluate feasibility of collecting baseline PROMs using the PROMIS framework in trauma and EGS patients.

Methods: Surveys reports will be collected from patients and through next of kin as a proxy. The PROMIS-29, PTSD screen, Trauma-Specific Quality of Life Questionnaire, and Gastrointestinal Quality of Life Questionnaire will be used as appropriate. Surveys will be administered within 48 hours of admission to the surgical intensive care unit, and again within seven days of anticipated discharge from the hospital. Patient responses will be compared to proxy responses using kappa coefficient.

Results: This is an on-going study and preliminary results will be available by the date of the conference.

Conclusion: We believe that PROM collection will be feasible in the ICU population, and that the responses from next of kin members will be reasonably concordant with those of patients. Over time, patients with critical care admission will have worse PROMs than those not admitted to the intensive care unit. Information gathered in this study will help to develop interventions aimed at improving short and long term outcomes in this population.

Poster 82

Presenter: Kristen Woody (University of New Mexico)
Mentor: Martin McMahon (School of Biological Sciences)

AP-1 Regulates Integrin β3 Induction by Sustained MAPK Pathway Activation

Abnormal Mitogen-Activated Protein Kinase (MAPK) signaling leads to increased or uncontrolled cell proliferation and resistance to apoptosis. BRAFV600E is the most common constitutively activating mutation in this pathway, and it is found in about 7% of all human cancers such as Melanoma, Thyroid Cancer, Lung Cancer, and Colorectal Cancer. This mutation increases cell motility using integrins. Integrins are important because they are involved in nearly every step of cancer progression from a primary tumor growth to metastasis. For our research, we are examining the regulatory mechanisms of Integrin Beta 3 (ITGB3) induction by sustained MAPK pathway activation. We are questioning if AP-1, a transcription factor that is targeted by MAPK, is required for expression of ITGB3. We hypothesize there won't be induction of ITGB3 after RAF activation when we knockdown expression of AP-1 genes. To test our hypothesis, we will be using short hairpin RNA (shRNA) to silence target AP-1 gene expression. We will then insert those shRNA into E.Coli plasmids. With our modified E.Coli plasmids, we will infect NIH3T3 mouse fibroblasts with the plasmids and examine the infected cells using a microscope and flow cytometry. Understanding this signaling pathway could lead to biomarkers of progression of melanoma and other cancers.

Poster 83

Presenter: Keith Clark (George Mason University)
Mentor: Michael Morse (Chemistry)

The Design and Construction of a Cryo-cooled Ion Photodissociation Spectrometer (CCIPS)

Molecules containing transition metals, lanthanides, and actinides thwart computational efforts due to their large density of electronic states. Our group's neutral labs use the high density of states to determine the bond dissociation energies (BDEs) of diatomic metal-containing molecules using predissociation. This summer I have been working toward the construction of a cryo-cooled ion photodissociation spectrometer (CCIPS), which will be used to measure the BDEs of metal-containing cations. This work provides accurate thermochemical data that can be used to test computational methods for these difficult species. In addition, for species where the molecular ionization energy is known, the thermochemical cycle BDE(M-X) + IE(M) = IE(M-X) + BDE(M+-X) may be used to test the accuracy of the four measured quantities. A major advantage of the CCIPS is that it can also be extended to measurements of the BDEs of metal cluster ions and larger organometallic complexes.

CCIPS is designed such that the ions are formed by laser ablating a metal sample in the presence of reactant gas. Ion optics guide the ion beam into a hexapole trap which briefly holds and thermalizes the ions. Upon their release, the ions pass through a first quadrupole mass filter (QMF), tuned to the mass of the ions of interest. A turning quadrupole then bends the ion beam 90 degrees, directing them into the cryo-trap where they are held, irradiated with a tunable laser, and released into the second QMF which is tuned for the mass of the expected fragment ion. Finally, the fragment ions arrive at the Daly Detector where individual ions are counted. By recording the fragment ion signal as a function of the laser wavelength, a photofragmentation action spectrum of the mass-selected ion can be obtained. In this poster I will provide an update on the progress in the construction of this instrument that has been achieved this summer.

Poster 84

Presenter: Ashley Evans (University of Northern Colorado)
Mentor: Tim Garrett (Atmospheric Sciences)
Using the Multi-Angle Snowflake Camera, MASC, to Look at Complex Snowflake Characteristics

Microphysical processes and hydrometeor forms are important when it comes to precipitation rates, storm lifetimes, avalanche predictions and radar measurements. But they are difficult to imitate in models. I want to know if flatter snowflakes are more likely to fall with a tilt. The Multi-Angle Snowflake Camera, MASC, was created to obtain high-resolution images of falling hydrometeors as well as measure fall speeds and other variables. It was found that snowflakes with a shorter maximum diameter fall the most frequently in Alta. Less of a correlation is seen between the aspect ratio and fall orientation of snowflakes with larger aspect ratios.

Poster 85

Presenter: Tommy Kawagoe (Grand Canyon University)
Mentor: Michael Morse (Chemistry)
Determination of Bond Dissociation Energies for MoC, ReN, and ReC

The chemical bond is of central interest in chemistry and provides fundamental information about the chemical and physical properties of compounds. Transition metal-containing species have posed a challenge to computational efforts to completely understand chemical bonding due to the complications of d-orbital bonding. Such endeavors often use bond dissociation energies (BDEs) as a benchmark for calculations, however BDEs for many transition metal-main group diatomic molecules are not known with enough precision to be useful or are not known at all.

The present work has determined the BDEs for ReC, ReN, and MoC to high precision. Molecules were produced by reacting a laser ablated metal sample (Re or Mo) with a carrier gas (CH_4 or N_2O in He) and were then interrogated using resonant two-photon ionization (R2PI) spectroscopy. Predissociation thresholds were observed at 5.731(3) eV, 5.635(3) eV, and 5.136(3) eV for ReC, ReN, and MoC, respectively. The molecular spectra for these molecules show a dense manifold of electronic states making the predissociation threshold a good estimation of the BDEs.

Poster 86

Presenter: Mckay Muhlestein (University of Utah)
Mentor: Natalya Kuznetsova (World Languages & Cultures)
BEREZNIKI: A Case Study of Contemporary Methods to Address Urban Shrinkage

Urban shrinkage is the process by which a city undergoes population decline for economic, demographic, or various other reasons. Russia is disproportionately experiencing urban shrinkage as most urban settlements have lost 70% of their populations since 1989. This research explores urban shrinkage in Russia using the industrial city of Berezniki as a case study. The study of urban shrinkage in Russia is still relatively new (see for example Batunova (2016) which looks at the southern Russian city of Zverevo). This project will contribute to this existing body of research by providing an additional case study from a very different region of Russia. Using population data, master plans, local journalism articles, contemporary case studies and background articles on urban shrinkage, this paper assesses the degree to which the situation in Berezniki is reflective of the general literature on urban shrinkage along with finding the main factors of population decline such as, the lack of economic opportunities, housing degradation, safety concerns, and infrastructure decline. Findings include Berezniki's current master plan to be largely in accordance with contemporary methods that mitigate adverse effects of urban shrinkage and the implications conclude that Berezniki has the potential to successfully navigate their urban shrinkage.

Poster 87

Presenter: Mariah Erickson (University of Utah)
Mentor: Jack Silcox (Psychology)
The N400 and Contextual Predictions in Language Processing

When listening to a speaker in unideal hearing conditions, greater effort is needed to perceive what is being said. This is referred to as effortful listening (Pichora-Fuller et al., 2016). Listeners often compensate for poor hearing conditions by using linguistic context from the ongoing conversation. Linguistic context is used to form predictions of the most probable utterances. This study used audiology and electroencephalography methods to assess how context-based predictions impact perception more thoroughly. Participants listened to cue-target word pairs where the target word was either congruent with the cue, semantically incongruent with the cue (incongruent baseline, IB), or semantically incongruent with the cue but phonologically related to the most predictable target word (phonological lure, PL). As an example, given the cue word PENCIL, CON: PEN, IB: TALL, PL: PAIR. Target words were embedded in background noise to increase listening effort. We examined word recognition accuracy, confidence, and the N400 event-related potential, which is a brain potential associated with the cognitive resources needed in order to make sense of a word (Kutas & Federmeier, 2011). Listeners showed high accuracy and confidence in word recognition for CON words. However, listeners showed lower accuracy but higher confidence for PL words compared to IB words. We observed large N400 amplitudes to IB words and small N400 amplitudes to CON words, replicating past work. Importantly, the PL condition resembled the CON condition early in word processing, suggesting that listeners may be pre-activating phonemic properties of likely upcoming words based on the context in the cue word. These findings may provide a neural basis for why listeners show worse accuracy in the PL condition: a phonologically related prediction may be leading to interference in word recognition to speech in noise.

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Presenter: Niwdé Rivera Maldonado (University of Puerto Rico at Mayagüez)
Mentor: Sebastian Hoch (Atmospheric Sciences)
Variations in pollution concentrations at the mouth of a tributary canyon during persistent cold-air pool conditions in Utah's Salt Lake Valley

In winter, the Salt Lake Valley and other topographic basins in northern Utah frequently experience persistent cold-air pools (PCAPs) under anticyclonic conditions. Stagnation of the stably stratified cold air in the topographic depressions

causes fine particulate pollution ($PM_{2.5}$) to accumulate. This often leads to exceedances of the 24-hour average National Ambient Air Quality Standard (NAAQS) for $PM_{2.5}$ of 35 $\mu g\ m^{-3}$.

Here, we investigate the 2-12 December 2020 pollution episode by analysing meteorological and air quality datasets from the Salt Lake Valley. While $PM_{2.5}$ shows a general increasing trend with time at sites at the valley floor, we find that concentrations at the mouth of Red Butte Canyon, a tributary canyon to the Salt Lake Valley, are modulated by thermally-driven up- and down-canyon flows. Ozone concentrations at the mouth of the canyon are also affected by these diurnal circulation patterns.

As the PCAP develops, daytime up-valley winds advect air with higher concentrations of $PM_{2.5}$ but lower concentrations of ozone to the mouth of Red Butte Canyon. At night, down-canyon flows lead to a reduction in $PM_{2.5}$ and to higher concentrations of ozone. As the PCAP pollution layer evolves, its top reaches a height corresponding to the mouth of Red Butte Canyon, which weakens the canyon flows. Under these conditions, counter-correlated oscillations of the concentrations of $PM_{2.5}$ and ozone are observed, indicating periods of sloshing of the particulate pollution layer into the tributary canyon that interrupt the nocturnal down-canyon flow pattern.

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Presenter: Debora Brito de Andrade (University of Utah)
Mentor: Tanya Flores (World Languages & Cultures)
"NADIE ME ENTIENDE" [NO ONE UNDERSANDS ME]: IMPACTS OF CULTURAL AND LANGUAGE BARRIERS ON SOCIAL ISOLATION AND LONELINESS IN SPANISH-SPEAKING OLDER ADULTS

Cultural and language barriers during the older stages of life can lead to an increased risk for social isolation and loneliness. Furthermore, Spanish-speaking adults are more likely to have poor access to care in Utah and in the rest of the United States, which decreases the likelihood that their mental disorders will be detected and treated. There is little data on how these issues particularly affect Spanish-speaking older adults in Utah. Therefore, the main goal of this research is to examine how language barriers affect social isolation and loneliness in Spanish-speaking older adults in Salt Lake County, Utah. A secondary goal is to examine whether the COVID-19 pandemic has exacerbated these issues. Information was gathered from both existing literature and through interviewing community members. Additionally, this project investigated how social isolation and loneliness have been tackled in Spanish-speaking communities in Utah and in other areas of the United States; this will be useful in determining the impact of existing organizations that assist older Spanish-speaking adults, and it also allows for comparison between Utah and other parts of the country. Overall, community coordinators revealed that the Spanish-speaking older adult population in Utah is more likely to be socially isolated than other Hispanic age groups due to greater cultural and language barriers. Mental health and community outreach resources have improved over the last few years, but there is still much more to be done. This research is significant because Spanish is a widely spoken language in the Hispanic older adult community. The findings bring light to the challenges faced by many Spanish-speaking older individuals in Utah and resources that have been successful in helping them. This will promote advocacy for this community and prompt improvements to decrease cultural and language barriers.

Poster 90

Presenter: Ryan Park (University of Utah)
Mentor: Skyler Jennings (Communication Sciences and Disorders)
The Effect of the Medial Olivocochlear Reflex on Auditory Nerve and Auditory Brainstem Potentials in Humans

Background: Despite modern hearing aids and cochlear implants, individuals with hearing loss struggle to understand speech in noisy backgrounds. Animal studies reveal that the medial olivocochlear reflex (MOCR) attenuates outer hair cell amplification of background noise (BN), freeing-up neural resources to code sounds of interest, such as speech. This effect is yet to be confirmed in humans. Studies on humans found that contralateral noise (CN), which is known to evoke

the MOCR, has been shown to suppress auditory nerve (Compound Action Potential [CAP], Smith et al. 2017) and brainstem (Envelope Following Response [EFR]) potentials (Mertez et al. 2016). Although this suppression is consistent with the MOCR, it is unclear whether additional central mechanisms contribute to the effects of CN on brainstem potentials.

Purpose: This study determined the relationship between CN suppression of auditory nerve and brainstem responses in humans. We hypothesize that the CAP and EFR potentials will decrease in the presence of CN.

Research Design: Four normal-hearing adults (1 male) between 19 to 24 years participated. CAPs and EFRs were measured from electrodes on the scalp and the tympanic membrane. The primary variable of interest was the effect of CN on CAP and EFR amplitude. This effect was measured under three repetition rates of the probe stimulus. Each participant received these conditions in random order.

Data Analysis: A sliding average of the CAP and EFR amplitudes across time was obtained and expressed as percent maximum amplitude. In order to test the hypothesis of reduced CAP and EFR amplitudes in the presence of CN a paired t-test of the mean amplitudes from the baseline and CN analysis windows was run.

Results: Only EFR amplitudes in the fast-rate condition showed a significant reduction in amplitude.

Conclusions: The suppression of EFR, but not the CAP amplitudes suggests either 1) the mechanism is central to the auditory nerve, or 2) the CAP is not sensitive to MOCR-based suppression by CN. Further research is needed to evaluate

Poster 91

Presenter: Lauryn Banks (Spelman College)
Mentor: Andrea Ibarra (School of Biological Sciences)
Potential role of OCA-B in lung function

OCA-B, also known as OBF-1 and BOB.1, is a transcriptional cofactor that has been studied and found encoded on the *Pou2af1* DNA region. It is most commonly found in B cells and lymphocyte activity and was once thought to be exclusive to only that**.** However, further research has shown that *OCA-B* is also expressed in memory T cells as well. It aids in the balance of Th1 and Th2 cells, which control immune cell signaling and humoral immune response, as well as differentiation of Th17. Outside of B cell and T cell expression, there is reasonable cause to believe that *OCA-B* is expressed within the epithelial layer of the lungs, affecting the human airway. Because most studies surrounding this topic have been performed using *Pou2af1 -/-* mice and human B cell lines, we have conducted an experiment using wildtype and knockout mice to further explore the human epithelium airway.

Poster 92

Presenter: Alejandro Pereira (University of Florida)
Mentor: Seyi Falekun (Biochemistry)
Investigating the Role of a Divergent Acyl Carrier Protein in Mitochondrial Genome Dynamics in Malaria Parasites

Malaria is caused by the unicellular parasite, Plasmodium falciparum, which is a eukaryotic pathogen that has a significant impact on global health. Most eukaryotes have complete type II fatty acids synthesis (FASII). In contrast, Plasmodium falciparum has lost FASII enzymes but retains a divergent mitochondrial acyl carrier protein (mACP) homolog, which canonically acts as a soluble scaffold for nascent fatty acid chain elongation. mACP contains an unusual amino acid mutation preventing its function as an acyl carrier protein, suggesting a FASII-independent function for mACP. We have shown by conditional knockdown that mACP is essential for blood-stage parasite viability by binding and stabilizing the core proteins required for mitochondrial iron-sulfur (Fe-S) clusters synthesis. This knockdown impacts Fe-S synthesis, therefore, the Riekse protein of the electron transport chain (ETC) gets destabilized, resulting in a

dysfunctional ETC. Since the loss of mACP indirectly affects the ETC, we hypothesize that mACP modulates the mitochondrial genome, which in Plasmodium exclusively encodes for three ETC proteins. To test this hypothesis, we used quantitative PCR to determine the DNA copy number and/or RNA levels of gene transcripts encoded on the mitochondrial genome. Preliminarily, our data show that loss of mACP results in the fluctuation of mitochondrial DNA and RNA gene copy numbers. Mitochondrial genes abundance for both DNA and RNA increased in the first cycle of loss of mACP conditions compared to when mACP translation is fully active but resulted in diminished mito genome and RNA levels at the end of the second cycle. Exploring this regulatory mechanism will further provide insights into the role of mACP to couple mitochondrial ETC function with maintenance and expression of the ETC components. This work will unveil new parasite biology and may suggest new targets for parasite-specific antimalarial therapies.

Poster 93

Presenter: Kaitlin Marler (University of Utah)
Mentor: Tom Richmond (Chemistry)
Cobalt Catalyzed C-F Bond Activation

Fluorocarbons are a necessity to our daily lives, with widespread uses that range from skin cancer treatments, important drugs, frying pans, refrigerator coolant, fishing lines and much more but can be a major pollutant in air and waterways. Perfluorocarbons have been termed "Forever Molecules"
because of their persistence in the environment since they currently cannot commercially or safely be broken down. Two major polluting fluorocarbons include CFC-11 which destroys the ozone layer and perfluoro-acids which pollute local water and air ways which can lead to lung dysfunction and other respiratory issues. Previous work in Carbon Fluorine activation has involved strongly reducing organometallic compounds which can be highly reactive and expensive to perform. In this work we explore classical cobalt bipyridine complexes with the common reducing agent borohydride to effect hydro defluorination of aromatic Carbon Fluorine bonds. This combination allows a fairly simple process that can break down one or more of these bonds. This process under nitrogen on a Schlenk line takes several days for the reducing agent to completely react, resulting in an obvious change in solution. Using F19 NMR spectroscopy we were able to confirm results regarding several Per-fluorinated compounds and whether or not they underwent hydro defluorination.

Poster 94

Presenter: Wesley Beck (Goshen College)
Mentor: Christian Malapit (Chemistry)
Selective electrochemical synthesis of chiral amines

Chiral amines are a highly prevalent functional group, appearing in a variety of pharmaceuticals and agrochemicals. This poster presentation describes the discovery and development of a novel electrochemical approach for the sustainable synthesis of chiral amines. Significant solvent and Lewis acid effects were observed, greatly improving both diastereoselectivity (up to >20:1) and yields (up to 95%). A broad substrate scope was obtained, allowing for the synthesis of amine products with various functionalities, e.g. heterocycle-containing amines, quaternary amines, and amino-acid derivatives.

Poster 95

Presenter: Brian MacArthur (University of Utah)
Mentor: Saveez Saffarian (Physics & Astronomy)
Purification of SARS-CoV-2 Virus-Like Particles for Cryogenic Electron Microscopy

In 2019, a novel coronavirus, SARS-CoV-2, emerged from Wuhan, China, and has since become a common research topic as scientists attempt to learn more about it. When working with infectious diseases, it's important to do everything possible to avoid infection in the lab and, because of that, virus-like particles (VLPs) are the key to understanding SARS-CoV-2. In early 2020, Saveez Saffarian and Michael Vershinin identified the three major proteins that contribute to the

overall structure of the virus and developed a method of reliably producing VLPs for study. My research focuses on the purification of these VLPs for use in extremely sensitive electron microscopes. Previously, purification methods for HIV VLPs had been developed but it quickly became apparent that a new approach was required for the somewhat more fragile SARS-CoV-2 VLPs. When exposed to tests of strength and longevity similar to those used with HIV, the virions from this new virus quickly broke down. In the future, we hope to publish gentle, yet effective, purification methods for SARS-CoV-2 VLPs for cryogenic electron microscopy (cryo-EM).

Poster 96

Presenter: Marisol Bustos (University of Texas San Antonio)
Mentor: Allie Graham (Human Genetics)
Investigation of Paraoxonase 1 (PON1) pseudogenization and transcriptional activity in Pinniped lineages

Various lineages of terrestrial mammals have recolonized the world's oceans, and have undergone millions of years of evolutionary constraint from the new environment. With their newfound transition into aquatic habitats come numerous physiological and molecular changes. One type of molecular change that can occur is pseudogenization, or mutations affecting a genes' ability to function, which does not always prove to be disastrous. Previous work has shown evidence of repeated pseudogenization events (or losses) of the *Paraoxonase 1 (PON1)* gene in aquatic lineages, including cetaceans (whales, porpoises), sirenians (manatees, dugongs), and pinnipeds (seals, sea lions).

The PON1 protein is thought to protect against lipid oxidation, with known roles as an antioxidant and anti-inflammatory; it is currently unknown how or why this gene was consistently lost in diving lineages. In addition, PON1 is responsible for hydrolyzing organophosphate pesticides - such pesticides are toxic to both intended (insects) and unintended lineages without a PON1. Both of these reasons highlight the importance of studying the pseudogenization landscape of PON1 in vertebrate lineages.

Therefore, we obtained museum tissue samples from 12 pinniped species and then used DNA and RNA sequencing methods to identify genetic lesions, as well as differences in expression of *PON1*. Ultimately we identify that pinnipeds have had at least two independent pseudogenization events within major families (1 in Phocidae, potentially 2 in Otariidae); in addition, we also find evidence of reduced transcriptional activity of PON1 across Phocidae, compared to other Carnivoran groups.

Poster 97

Presenter: Dillon Crytser (West Virginia University)
Mentor: Jacob George (Electrical and Computer Engineering)
Assistive Bionic Arm: A Powered Exoskeleton to Assist Dexterous Hand Grasps and Wrist Movements

There are over 800,000 new stroke patients each year and eight out of ten of them suffer from muscle weakness on one side of their body that limits the functional range of motion of their joints. Powered exoskeletons can restore upper-limb motor function to these stroke patients using actuated joints that provide supplemental power to assist with joint movements. Clinically available powered exoskeletons, such as the MyoPro, are limited in that they are costly and only provide assistance with elbow movement and a three-finger pinch movement. Here we showcase two additional actuated joints for the MyoPro exoskeleton that enable two novel movements – power grasp and wrist flexion/extension – that are built from a small number of 3D-printed parts for under $130. To enable power-grasp, six 3D-printed parts attach digits four and five to a servo motor and the MyoPro exoskeleton. To enable wrist flexion/extension, a single 3D-printed part attaches a servo motor to the wrist flexion/extension joint on the MyoPro exoskeleton. This work demonstrates that low-cost 3D-printed components can readily provide additional actuated joints to preexisting clinical exoskeletons. These additional actuated joints can be used by engineers to explore novel control strategies of multiarticulate upper-limb exoskeletons. Ultimately, more dexterous powered exoskeletons may improve stroke rehabilitation and provide patients with improved functionality in activities of daily living.

Poster 98

Presenter: Kenny Goler (University of Utah)
Mentor: Gail Zasowski (Physics & Astronomy)
Andromeda Analogs: Analyzing the Milky Way's Strange Neighbor

Andromeda (M31) is the closest large galaxy to our own Milky Way, and will collide with it one day. It is viewed from a near-edge-on-angle, which makes it difficult to view its morphological structure. Here, we study the morphological traits of galaxies identified as M31 analogs (M31As), using multiple complimentary sample definitions.. We analyzed morphological traits of the samples including overall galaxy classification (T-Type), bar probability, disk probability, bulge probability, ring probability and spiral arm count. It was found that the original analog samples selected for an unexpectedly high number of elliptical galaxies (negative T-type values), so we created additional analog samples by restricting to positive T-types only. This study shows that an additional T-Type cut to the selection criteria provides a more precise analog selection. Likewise, as more Andromeda traits are added to the selection criteria, the analog galaxies become more likely to show a ring structure. This suggests that rings are a common feature in M31-like galaxies.

Poster 99

Presenter: Bianca Paulino (University of Utah)
Mentor: Casey Mullen (Sociology)
How Participatory Air Quality Sensing Shapes Participants' Exposure Experiences: Perceptions and Challenges of Mitigating Exposure Pre-Sensor Distribution

The focus of our research was to study how participants engage in participatory air quality sensing to inform their understandings about exposure to air pollution and in decision-making to mitigate exposure. Our study consisted of pre- and post-interviews with participants that received sensors from us for the study. This presentation will focus only on the preliminary findings of the pre-interviews. Our preliminary findings found that 1) Perceptions of the correlation between indoor and outdoor air quality and participants ability to mitigate sources of pollution 2) Perception and identification of concerning pollution sources close to home and 3) Challenges of mitigating exposure due to renter status.