



Office of  
**UNDERGRADUATE RESEARCH**  
THE UNIVERSITY OF UTAH

# 2022 Summer Symposium

**THURSDAY, AUGUST 4, 2022**  
**9:00AM - 12:00PM**  
**ALUMNI HOUSE**  
**UNIVERSITY OF UTAH**



**2022 SUMMER SYMPOSIUM**  
Thursday, August 4, 2022  
9:00 AM – 12:00 PM  
Alumni House Ballroom  
University of Utah

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

We are also thankful for the Summer Programs Partnership, which is a collaboration among the Beckman Scholars Program, Chemistry Research Experience for Undergraduates (REU), the Genomics Summer Research for Minorities (GSRM) Internship, the Huntsman Cancer Institute's PathMaker Cancer Research Program, the Native American Summer Research Internship (NARI), the Physics & Astronomy REU, Research Experience to Advance the Careers of HBCU Undergraduates at the UofU (REACH U2) in Health Disparities Research, Research Experience in ALpine Meteorology (REALM) REU, Research Experience in Utah for Sustainable Materials Engineering (ReUSE) REU, RUUTE Summer Undergraduate Research Experience (SURE), Summer Program for Undergraduate Research (SPUR) and Summer Undergraduate Research Internship in Pharmaceuticals and Drug Delivery. Together, these programs are serving more than 200 undergraduate researchers in Summer 2022.

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

## **PROGRAM SCHEDULE**

**NOTE:** All student presenters **MUST** check-in

8:30–9:00AM	<b>CHECK-IN &amp; POSTER SET-UP</b>
9:00–10:30AM	<b>POSTER SESSION I</b>
10:30AM–12:00PM	<b>POSTER SESSION II</b>
12:00PM	<b>CLOSING REMARKS</b>

# SCHEDULE OF PRESENTATIONS

## POSTER SESSION I 9:00 – 10:30 AM

### Poster 1

**Presenter: Brenda Acosta** (Utah Valley University)

Mentor: Melodie Weller (Dentistry)

*Optimizing Scientific Protocols for RNA Isolation From Fixed Tissue*

Detection of pathogens in environmental specimens is challenging due to the rapid degradation of nucleic acids based on preservation techniques used. A study was designed to evaluate two protocols for specimen preparation for optimized preservation and integrity of cellular and viral RNA: 1) formalin-fixed paraffin embedded (FFPE) sample processing and 2) optimal cutting temperature (O.C.T.) embedding compound for fixed and frozen tissue specimens. Tissues were fixed with 10% formalin for 24hr or 48hr prior to being embedded using either the FFPE or the O.C.T. scientific protocol. RNA was then isolated from 5µm thick slices using a Qiagen RNeasy FFPE Kit. RNA quantity was measured with Qubit™ RNA High Sensitivity (HS) Assay Kit and RNA integrity was assessed using Qubit™ RNA IQ Assay Kit.

The objective of this study was to determine the optimal protocol for isolation of RNA from environmental samples. This study focused on the FFPE and O.C.T. protocols. Each protocol had its own timeframe, challenges, and implications. FFPE required longer sample processing time, more reagents for step-wise tissue dehydration, and instrumentation to facilitate embedding specimens into hot paraffin wax. The O.C.T. protocol required less time and reagents to process samples. The RNA isolation using the FFPE and O.C.T. protocols was used to determine the optimal RNA concentrations and integrity for 24hr and 48hr fixed tissues. For the OCT protocol, the RNA concentrations were lower than for the FFPE protocol. For FFPE, the 48hr fixed tissue had a higher RNA concentration than the 24hr fixed tissue. Both the FFPE and OCT provided an efficient RNA integrity score required for downstream NGS processing. FFPE specimen processing rendered higher levels of RNA and similar RNA integrity scores as compared to the O.C.T. protocol. The FFPE protocol will be utilized in follow-up studies to characterize and isolate low-level pathogen signatures from environmental specimens.

### Poster 2

**Presenter: Diyar Ahmed** (University of Utah)

Mentor: Jun Yang (Neurology)

*CEP 250 is necessary for centrosome cohesion during spermatogenesis and to provide maintenance of stem cells in testes*

The process of spermatogenesis is in jeopardy due to the possibility of lacking an important gene known as Cep 250. The Cep 250 mutant mice exhibited a significant defect. In these mice, sperm production was completely abolished due to meiotic obstruction and a dramatic reduction in the spermatogonial pool. C-NAP1 (encoded by CEP250) is a large intertwined centrosomal protein with a 2,442 amino acid chain responsible for interacting with rootletin and other proteins. The centrosomal protein is necessary for regulating centrosome cohesion during the cell cycle in somatic cells. New studies have shown that CEP250 is also essential for centrosomal regulation during male gametogenesis. In addition, the testis exhibits the highest CEP 250 expression levels for germ cells compared to the somatic tissues. These findings indicate a possible role of CEP250 in mitosis and meiosis during spermatogenesis. We have generated a new Cep250 mutant mouse line using CRISPR/CAS 9 technology to mimic patient mutations. We have also developed and characterized two C-NAP1 antibodies. Using these resources, we explored the potential molecular mechanism underlying the spermatogenesis defects caused by Cep250 mutations. We first performed the immunofluorescence for C-NAP1 on testis sections to verify the Cep250 mutation. We then examined the cellular location of several centriolar proteins in Cep250 mutant testes. Our results demonstrated that our Cep250 mutation affects C-NAP1 protein expression in testis. However, our C-NAP1 antibodies also detected an unexpected signal close to the lumen region of the seminiferous tubule. We are in the process of localizing other centriolar proteins in our Cep250 mutant testes.

### Poster 3

**Presenter: Danielle Alvarado** (University of Utah)

Mentor: Tracey Omega (Population Health Sciences)

*Intergenerational differences in health information and digital technology use among Latina women in the US*

Digital technologies are widely used to access and facilitate health information, and for cancer control activities. Increasingly, digital technology interventions are being tailored to address cancer inequities, such as among Latina women in the U.S., for whom early detection rates are lower than other groups. The purpose of this study is to understand the use of digital technologies across age groups among Latina women in the U.S. and identify generational differences that will inform best approaches to cancer health equity interventions. I conducted a literature review through PubMed and Google Scholar to identify gaps in evidence related to digital technology use among Latina women by age. We obtained from Health Information and National Trends Survey (HINTS) 5, Cycles 1-4 data (2017-2020), administered through the National Cancer Institute. Our study cohort included Latina/Hispanic women ages 18 and older responding to



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the survey in either English or Spanish. Descriptive analyses characterized digital technology use patterns by age group quartiles (18-37, 38-50, 51-63, and >63) and multivariable logistic regression analyses tested age group in relation to use.

The absence of evidence for digital technology use by age among Latina women in the literature motivated our study, which include 1,181 women (N=312 ages 18-37; N=300 ages 38-50; N=280 ages 51-63; N=289 ages >63). The internet was the dominant source of health information for the younger women, but decreased dramatically for the older women (42.3% v. 13.8%), while a doctor or health care provider increased by age (39.2% for 18-37yrs. v. 55.4% >63 years). Older Latina women in the U.S. are less likely to benefit from cancer control interventions deployed through digital technologies. To address cancer disparities in this population, multiple modes of intervention, both digital and non-digital need to be used, given that cancer risk is highest in the older age groups.

### Poster 4

**Presenter: Abdul Moez Ayubi** (University of Utah)

Mentor: Thomas Zangle (Chemical Engineering)

*Matrigel microwell fabrication for studying tumor cell behavior in the presence of support cells*

Cancer is a complex and dynamic disease and identifying effective treatment for individual patients is often difficult. One method for identifying effective therapies is by testing with patient-derived models of cancer, such as patient-derived xenograft organoids. However, such models are often limited in their ability to study the interactions between tumor cells and support, or stromal, cells, and how these support cells affect tumor cell growth and the emergence of resistance to treatment. In this work, we demonstrate the design and testing of a device to create an array of microwells made from matrigel, a hydrogel made from extracellular matrix proteins. This device is designed to allow for support cells to be embedded inside the microwell walls, with tumor cells grown inside the microwells. This geometry, therefore, allows for interactions between the two cell types, while maintaining a spatial barrier between them so that the therapy response of the two cell types can be measured independently. To develop this device, we designed a 3D model of the microwell array using 3D modeling software, which was then used to print a mold using a high-resolution 3D printer. This mold was then used to make a PDMS negative for the microwell array that could then be used to cast the matrigel array of microwells. Overall, we believe this method is a promising direction for studying how stromal cells impact the behavior of tumor cells. Future work will use this approach for studying the growth of tumor cells with and without the support cells embedded in the matrigel.

### Poster 5

**Presenter: Abdul Bari Ayubi** (University of Utah)

Mentor: Beatrice Knudsen (Pathology and Institute of Scientific Computing and Imaging)

*Microscopic Examination of Inflammatory Bowel disease*

Inflammatory bowel disease (IBD) causes abdominal pain, bleeding, fatigue, and weight loss. IBD involves parts of the intestine through an inflammatory process. The trigger of the inflammatory process, which consists of acute and chronic inflammation remains poorly understood. Patients diagnosed with IBD require lifelong treatment and surveillance for the early detection of cancer. The surveillance of patients and assessment of disease activity occurs through microscopic analysis of biopsies that are taken in the endoscopy suite. The biopsies are sent to Pathology where they are processed into glass slides. The glass slides are examined through a microscope by a pathologist. Alternatively, the glass slides are converted to digital files that are analyzed by a computer. Multiple manual grading schemes have been developed to communicate the severity of inflammation. However, they are laborious and time-consuming to perform by pathologists. Computers can be trained to assist pathologists in the assessment of disease activity. As the number of pathologists is declining, computers will play an important role in the future in helping to manage patients with IBD.

### Poster 6

**Presenter: Ama Baffour**

Mentor: Skyler Johnson (Radiation Oncology)

*Complementary and Alternative Medicine Exposure in Oncology (CAMEO) Study: A multi-institutional cross-sectional analysis of rural cancer patients in Utah*

The use of complementary and alternative medicine (CAM) has been associated with detrimental effects on survival outcomes in cancer patients compared to standard of care medical interventions. Improvements in cancer survival have not been realized at the same rate for rural patients than urban patients and may be associated with CAM use. We sought to understand CAM use and perceptions in rural cancer patients in Utah.

### Poster 7

**Presenter: Grace Baumgartner** (Worcester Polytechnic Institute)

Mentor: Matt Sigman (Chemistry)

*Product or Reactant: What Determines the Rate of an Amide Coupling Reaction?*

The amide functional group is integral in biological systems and medicinal chemistry. In synthesis, amides are most commonly formed in an amide coupling reaction; wherein an amine and a carboxylic acid combine in the presence of a coupling reagent. Previous work employed acid and amine molecular descriptors to develop an interpretable model for the prediction of reaction rate. However, the utility

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of amide product descriptors in this endeavor had not been explored, largely due to the high computational cost of calculating the combinatorial product space as compared to the far fewer and less complex reactants.

In this study, we investigate to what extent amide descriptors impact models of amide coupling reaction rate. We also consider how well amide descriptors can be predicted using the descriptors of their components (i.e., acid and amine).

The matrix of amides formed from a previous study's training set was chosen as a representative set for this study. This representative set was passed through a computational workflow; first, conformational ensembles for each structure were generated, then the conformers were optimized using DFT, and lastly, descriptors were extracted to describe each member of the conformational ensemble. Multivariate linear regression (MVLRL) algorithms were used to correlate amide descriptors with linear combinations of acid and amine descriptors. Since these reactant/product correlations were typically very poor, we concluded that amide descriptors did contain different combinatorial information than their acid and amine descriptors. However, when MVLRL rate models were generated using amide descriptors, their predictive power was found to be comparable or worse than their acid and amine analogs. This implies that the chemical properties of the amide product are less relevant to the coupling reaction than those of the reactants. Therefore, the computationally simpler acid and amine descriptors are found to be the best predictive tools.

### Poster 8

**Presenter: Sarah Bayardo** (University of Utah)

Mentor: Anne Kirchhoff (Pediatrics)

*The impact of air pollution exposure on childhood cancer survivors: creating and obtaining feedback on an informative brochure.*

**Introduction:** Air pollution is a significant public health problem that is linked to many cancer types. To inform childhood cancer survivors, their families, and caregivers about the potential negative impact of air pollution exposure, we created an informative brochure on this topic. We received feedback on our first brochure draft through an online survey sent to researchers connected to Huntsman Cancer Institute (HCI).

**Methods:** We conducted a systematic literature review on the potential risk childhood cancer survivors face when exposed to air pollution through PubMed; 22 papers were reviewed and summarized. We compiled our findings into a brochure created for parents and caregivers of young cancer survivors. A survey was created and sent to 45 HCI staff and researchers to get feedback on the brochure's phrasing, language, and visual appeal. The questions on our survey included demographics, familiarity with air pollution science, brochure understandability, opinions on brochure visuals, and feedback on how the brochure could be improved. Data collection is ongoing.

**Results:** A total of 17 participants completed the survey; 88.2% are females, with 70.6% having more than a 4-year college degree. The majority (88.2%) found the brochure "not hard to understand," and 88.2% of participants did find something new that they learned. We asked if the brochure was ready to be released on a scale of 1 to 10, 1 for "no ready" and 10 for "ready" the mean was 8.33. The favorite elements of the brochure were the visuals (100%) and the key messages (75%). The least favorite elements were the formatting and the colors.

**Conclusion:** Our brochure received generally positive feedback. Creating approachable ways of expressing scientific information is vital to protecting vulnerable populations such as children from air pollution. The following steps include getting feedback from parents and caregivers of survivors for future dissemination.

### Poster 9

**Presenter: Marlon Lopez** (University of Utah)

Mentor: Anne Kirchhoff (Pediatrics)

*Creating and obtaining feedback on a childhood cancer and environmental health brochure: Results from researcher survey*

**Introduction:** Environmental factors are linked to increased risk for cancer. Our goal is to inform the public about how environmental carcinogens may affect the risk of cancer by creating a brochure on this topic for parents and caregivers of childhood cancer survivors. We received feedback on the brochure through an online survey sent to researchers connected to Huntsman Cancer Institute (HCI).

**Methods:** We conducted a systematic literature review on environmental carcinogens in PubMed; in total, 11 papers, relating to environmental carcinogens, were reviewed and summarized. We then compiled a brochure for caregivers of young cancer survivors. We created and sent out a survey through REDCap to HCI researchers. The survey questions included demographics, comprehensibility, if the information was educational, their preferred section, and how ready the brochure is to be released.

**Results:** The survey was sent to 26 researchers; 19 had usable survey information. Of these, 76.5% of had more than a 4-year college degree; 73.7% were somewhat to very familiar with the field of environmental health. Around 21.1% said they knew a lot about environmental health. The majority (89.5%) found the language of the brochure "not hard to understand" and 78.9% of participants reported learning something new. Most participants indicated the content on how to reduce exposure as their favorite (64.7%). On a scale from 1-10 for whether the brochure was ready for dissemination (1=not ready; 10=completely ready), the mean was 6.29.

**Conclusion:** The brochure received positive feedback from participants. Participants expressed mostly favorable opinions on the brochure's contents. Creating approachable ways of communicating scientific information is vital to protecting vulnerable children from environmental carcinogens. Next steps include getting feedback from parents and caregivers of survivors for future dissemination.

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### Poster 10

**Presenter: Arnel Besic** (University of Utah)

Mentor: Connor Bischak (Chemistry)

*Making and Characterizing Electropolymerized Polymers*

Organic Mixed Ionic Electronic Conductors are conjugated polymer systems that are conductive to both ions and electrons. They have implications in biosensors, neuromorphic computing, and energy storage. This work presents the electropolymerization and characterization of various thiophene based polymers and copolymers. These thiophene polymers were created by applying a constant voltage to a system containing an ITO glass working electrode, an Ag/AgCl reference electrode, and a Pt mesh counter electrode. The polymers were dissolved in acetonitrile and were accompanied with lithium perchlorate. The polymers are characterized by cyclic voltammetry and spectroelectrochemistry in water and potassium hexafluorophosphate. They then will be further characterized by FTIR, SEM, and AFM. These polymers have been successfully created, showing they may be used in more efficient device fabrication and may soon replace traditional technologies.

### Poster 11

**Presenter: Alex Billings** (University of Utah)

Mentor: Melissa Cortez (Neurology)

*The Exploration of Chromatic Light Effects and Light Sensitivity Levels in Patients with Autonomic Dysfunction*

Patients with autonomic dysfunction often experience hypersensitivity to light.<sup>1,2</sup> Prior research suggests that various chromatic light sources might elicit unique neurally mediated responses under differing chromatic conditions.<sup>3</sup> Furthermore, some clinics already empirically offer colored lenses or light therapy,<sup>4,5</sup> though there is inconclusive scientific evidence to support these treatments. This project aims to explore chromatic light effects on autonomically mediated pupillary light responses using a psychophysical testing methodology and will explore how these effects might be used to clinically assess and alleviate symptoms of migraine, light sensitivity, and other autonomic dysfunction affecting pupillary function. We will utilize three devices in our testing methods: a quantitative pupillometer, an intuitive colorimeter, and a photophobia threshold testing (PPT) rig. The pupillometer allows us to record and measure the pupillary light response (PLR) in reaction to white, red, green, and blue light. The Intuitive Colorimeter allows us to control and vary the three dimensions of color—hue, saturation, brightness—to let the participant pick a therapeutic and aversive hue that is then matched to tinted lenses. These lenses are then worn during PPT testing, which allows us to measure a participant's capacity to view bright lights by recording lux values. The results of this exploration will evaluate color effects from chromatic light and begin to understand the potential use of chromatic light as a therapeutic treatment in those with autonomic dysfunction.

### Poster 12

**Presenter: Brielle Bingener** (University of Scranton)

Mentor: Jan Kubanek (Bioengineering)

*Optimization of brain slice health for ultrasonic stimulation*

There is a critical need to develop noninvasive treatments for drug-resistant neurological disorders. Focused ultrasound is a noninvasive modern technology that can provide mm precision and target deep brain structures. Yet, it is unknown what the effects of ultrasound are on different cell types in the brain. Our goal is to develop a method to determine the effect of ultrasonic stimulation on neural activity visualized with the genetically encoded calcium indicating protein GCaMP6s. When optimizing a method to image action potential-dependent calcium responses, it is crucial to ensure brain slice health; as cell death can occur during preparation of brain slices and in the imaging environment. We selected Thy1-GCaMP6s mice for use in these studies due to superior fluorescence in CA1 hippocampal cells (Dana et al., 2014) and the ability to detect active neurons (Chen et al., 2013). We imaged using two microscopes to confirm continuity of slice health in different imaging environments. Using a Zeiss Axioskop fluorescence microscope imaging at 12 Hz in acutely prepared hippocampal brain slices obtained from Thy1-GCaMP6s (n=2) mice, we determined that the protective recovery method used for slice preparation and our solution conditions for imaging were sufficient for imaging neuronal activity. This success is marked by imaging predominantly healthy cells with full somas. During imaging Thy1GCaMP6s (n=2) with an Olympus BX51 illumination turret, 10x water immersion .3NA objective, and GFP filter set, we determined the recording temperature of 30-32°C and 7.35 pH was sufficient for healthy brain slices as observed by non-bloated cells in the imaging environment. Additionally, we observed brain tissue viability for a minimum of six hours. Optimization of slice health and the imaging environment for the tissue will allow us to create a novel experimental setup for ultrasonic stimulation of brain slices in the future.

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### Poster 13

**Presenter: Katie Bishop** (Utah State University)  
Mentor: Chen Wang (Materials Science and Engineering)  
*Biodegradability of photopolymerized thiol-ene films*

Non-biodegradable films are used to coat paper, which makes it more difficult to recycle. Clear, bendable films made from thiols and alkenes were created to mimic non-biodegradable plastic films. The thiol-ene films were placed in a phosphate buffer solution to measure the rate of biodegradation. The films were also tested in NaOH and HCl solutions.

### Poster 14

**Presenter: Elijah Bliss** (Utah Tech University)  
Mentor: Peter Armentrout (Chemistry)  
*Lanthanide Chemi-Ionization Chemistry: An Evaluation of Reaction Efficiency.*

The region of the atmosphere known as the ionosphere is susceptible to a process known as scintillation due to fluctuating levels of plasma densities. Plasma density discontinuities can cause radio frequency signals to be lost, disrupting communications for up to several seconds. The United States Air Force has an interest in mediating scintillation and has explored the use of lanthanide chemi-ionization reactions ( $\text{Ln} + \text{O} \rightarrow \text{LnO}^+ + \text{e}^-$ ). Understanding the efficiency of these chemi-ionization reactions across a wide range of energies can inform the selection of an appropriate lanthanide to address ionospheric scintillations. Using a Guided Ion Beam Tandem Mass Spectrometer, the chemi-ionization reaction has been studied across energies ranging from 0.01 - 1 eV (approximately 100 - 12,000 K). Products collected from reactions of lanthanide cations with diatomic oxygen, carbon dioxide, and nitrous oxide have been collected and analyzed. A periodic trend consistent with the promotion energy required to initiate bonding between the chemical species relates the reaction efficiency of each metal. The information this trend provides will be helpful for the selection of the lanthanide used in the chemi-ionization reaction.

### Poster 15

**Presenter: Aris Bougas** (Colorado University)  
Mentor: Adam Hughes (School of Biological Sciences)  
*Learning about Citrullinemia*

Citrullinemia is one of many types of inborn errors in metabolism. The ASS1 and SLC25A13 genes are significant in the urea cycle which is one part of metabolism. We try to learn about these genes using yeast homologs of ARG1 and AGC1 respectively. By learning more about the enzymes they code and the transporters they code we may learn how better to bridge the gap between arginine and citrulline to arginosuccinate in the future. This could help the body of people with citrullinemia to begin to process nitrogen like healthy people thus removing it from the body in the form of urea. This could save the lives of about 1/57000 people. Currently, specific diets, dialysis, and liver transplants are the treatments available.

### Poster 16

**Presenter: Mason Burden** (University of Utah)  
Mentor: Shanti Deemyad (Physics & Astronomy)  
*Electronic and Material Properties at Extreme Conditions*

To better understand the world around us and predict the manner with which it will function, we must first understand the properties of the materials that compose it. However, in further exploring the behavior of materials beyond our usual ambient surroundings, many obstacles obstruct regular measurements of these exotic substances. To measure properties such as resistivity, magnetoresistivity, and x-ray diffraction, we utilize a variety of transport measurements. Through the studies of matter at extreme conditions, our lab has become proficient in employing transport measurements to map the material and electrical properties of materials at interest. In making these measurements, we were able to refine both the physical systems and the software we used to cut out noise and error and to allow us to present much more reliable data. In educating about and implementing these systems, we can further the reliability and proficiency of condensed matter research across the discipline.

### Poster 17

**Presenter: Calista Cannon** (University of Utah)  
Mentor: Nancy Songer (Educational Psychology)  
*Curricular Solutioning: Steering Adolescent Science Learning Toward Local Problem Solving.*

This project has three main missions: create a six-week solution-based biology curriculum, discover how adolescent learning responds to it, and observe the kinds of learning that surface from involvement in the program. This study was constructed to spread scientific thinking and critical scientific values more broadly throughout society. A main objective of the science curriculum is to combine scientific investigations with engineering solution design to guide students in creating solutions to local problems. The program emphasizes biology, nature, science, engineering, and problem-solving. It's novel because biology learning is intersected with science engineering tasks. Six

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middle school classes taught by one teacher implemented this new curriculum. Pre-post data were gathered from the 129 middle school students. Paired t-tests were conducted for the students' pre-/post-test scores to examine the effect of the solutioning curriculum. Pre- (M = 6.26, SD = 3.57) and post-test (M = 9.99, SD = 4.03) total scores showed a significant improvement ( $t(128) = -12.33$ ,  $p < 0.0001$ , 95% CI [-4.38, -3.12],  $d = 1.07$ ). These student data results demonstrate significant learning gains after participating in the solutioning program. This solution-based learning is important in acquiring necessary science tools needed for navigating the world.

### Poster 18

**Presenter: Alejandra Cardenas Montañez** (University of Puerto Rico at Bayamón)

Mentor: Alana L. Welm (Oncological Sciences)

*The potential role of P-JNK in metastatic breast cancer dormancy*

A major concern of breast cancer (BC) is metastatic recurrence when clinically disease-free patients relapse and die as a result of lack of curative therapy. This multistep process involves a population of disseminated tumor cells (DTCs) which escape primary tumors and seed into secondary sites. To further study the concept of dormancy, as there is a long latency period of months to decades between tumor removal and relapse, we combined an ex vivo stage IV HER2+/ER+ BC woman rapid autopsy (RA) model with an in vitro proliferative D2A1 and dormant D2OR breast cancer cell lines model. A protein of interest, i.e. P-JNK, was previously found through spatial proteomics to be upregulated in regions of grossly uninvolved (GU) tissue that contained DTCs when compared to those without them in the RA study. To test our hypothesis that P-JNK could be involved in breast cancer dormancy/reawakening, we performed a multiplex immunofluorescence staining for HER2/P-JNK/Ki67/CC3 where P-JNK seems to be expressed at the cell membrane along cancerous tissue, while the expression pattern in GU tissue involves progression P-JNK expression as DTC clusters become larger and form micro-mets. To characterize P-JNK expression in vitro, western blots were performed for 2D cell culture and 3D tumorsphere assay conditions. P-JNK seems to be expressed differently with higher expression by D2OR in 2D setting but by D2A1 in 3D which better models self-renewal capability and stemness viability. We aim to better understand the mechanisms of tumor dormancy/reawakening as it would help us tackle its re-emergence to improve survival of patients.

### Poster 19

**Presenter: Spencer Carstens** (University of Utah)

Mentor: Shreya Goel (Pharmaceutics & Pharmaceutical Chemistry)

*Evolution of the Metastatic Tumor Microenvironment Through High Resolution Microscopy*

Despite metastasis accounting for the vast majority of cancer deaths, our understanding of the complex interactions between a metastatic tumor and its microenvironment is still lacking. With cancer being a disease that impacts millions of people worldwide, understanding the metastatic process and its progression is critical for the development of more effective therapies. One way to better understand the factors that allow a metastatic tumor to form is by observing the changes in the microenvironment as the tumor grows.

My project investigates the evolution of a metastatic tumor's microenvironment through the use of high resolution microscopy. This is performed by taking photographs of metastatic tumors that have fluorescently tagged vascular, ECM, and immune biomarkers at different stages of tumor growth. Using an image analysis software, the intensity of each biomarker can be recorded and the relationship between biomarker presence and tumor growth can be observed.

### Poster 20

**Presenter: Marco Castaneda** (California State University, Dominguez Hills)

Mentor: William Anderegg (School of Biological Sciences)

*Forest Resilience: Aspen Physiological Responses to Drought*

Trembling aspen, *P. tremuloides*, plays an important role in promoting biodiversity, providing ecosystem services, and sequestering carbon. Aspen grows in many climates and environments throughout North America, ranging from the arid conditions of the southwest to mesic conditions of more northern latitudes. Aspen is experiencing a range contraction caused by Sudden Aspen Decline (SAD) and exacerbated by warming temperatures and lack of precipitation. A garden experiment was conducted to compare how aspen from three distinct climatological regions (Dixie, Uncompahgre, and White River National Forest) will physiologically respond to one-year drought treatment. To determine which population is more likely to have a less adverse response to drought; Chlorophyll fluorescence, stomatal conductance, and leaf water potential from each individual were analyzed. There was no change in physiological responses between population and treatment groups. Which could mean that all three populations have similar phenotypic adaptations to water stress, but further research is necessary. The results could also mean that one year of treatment drought is not enough, and the experiment could express different results with repeated years of drought. Future research in tree physiological responses to drought is crucial for designing restoration projects that provide long-lasting benefits for North American Forests.



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### Poster 21

**Presenter: Guadalupe Castañeda-Hernandez** (Princeton University)

Mentor: Katie Basham (Oncological Sciences)

*Investigating the Role of Sex Hormones in Adrenal Cancer and Proliferation*

The adrenal gland is a vital organ that produces hormones to regulate essential body functions. Sex hormones are a class of chemical messengers that control development and reproduction. In the adrenal, male sex hormones known as androgens, have been shown to negatively control cell proliferation, ultimately leading to cancer. We are interested in understanding how androgens mediate cell proliferation. We hypothesize that the removal of androgens increases cell proliferation in adrenal cancer. To investigate this question, we used a conditional genetic knockout mice model (*Znrf3 cKO*) representative of adrenal cancer and performed either a gonadectomy(GDX) or sham procedure at 4 weeks and harvested the adrenal at 9 weeks. To validate the absence of androgens, we performed immunohistochemistry staining(IHC) for *20αHSD*, which confirmed the retention of the x-zone, characterized for regressing as androgens increase during puberty, in GDX mice. Next, we evaluated the following factors to determine the changes in adrenal cortex proliferation based on GDX or sham treatment in *Znrf3 cKO* mice. Normalized adrenal weight in GDX mice demonstrated a 2.9-fold increase compared to sham. Protein expression for *Ki67* using IHC displayed an increase in positive staining for proliferation in GDX mice compared to sham. Next, hematoxylin & eosin staining surprisingly exhibited a significantly lower number of fused immune cells in GDX mice compared to sham. Lastly, *CD68* staining confirmed the presence of large macrophages which decreased significantly in GDX mice compared to sham. Removing androgens from GDX male mice allowed us to measure the major difference between the immune response in GDX and sham treated mice. Overall, the removal of androgens in *Znrf3 cKO* GDX mice increased adrenal weight, elevated the percentage of fused macrophages, facilitated proliferation, and decreased *CD68* positive immune cells. Going forward, this highlights the importance of understanding the effects of hormones in mediating cell proliferation and immune recruitment in the context of adrenal cancer.

### Poster 22

**Presenter: Hope Caviness** (Baylor University)

Mentor: Brennan Payne (Psychology)

*Neurocognitive effects of listening effort on speech perception in older adults: Evidence from event-related brain potentials*

**Purpose:** In older adults, there is a clear relationship between hearing loss and cognitive disruptions, including negative effects on speech comprehension. This leads adults to distancing themselves from participating in daily communicative activities. The goal of the current study is to use cognitive event-related brain potentials (ERPs) to understand higher-level cognitive and brain functions as adults listen to perceptually demanding speech (e.g., in background noise).

**Method:** We measured ERPs as older adults (N = 48, mean age = 71; range = 60 - 85) listened to sentences with expected and unexpected sentence-final words either in quiet or with background noise. We measured two cognitive ERPs time-locked to the sentence-final word: the N400 and the frontal negativity.

**Results:** We found that the N400 response, which indexes semantic processing, is delayed in background noise. This indicates that the early retrieval of words from long-term memory is hindered when listening effort is high. In addition, we observed a frontal negativity to expected words in quiet, which has been linked to high-level working memory related comprehension processes. This frontal negativity was eliminated in background noise. Thus, high-level comprehension processes are diminished when increased listening effort is required to overcome perceptual limitations.

**Conclusion:** This study demonstrates underlying differences in brain activity in older adults when processing auditory input in quiet compared to noise. Our findings demonstrate that older adults experience delays in word retrieval and reductions in high-level comprehension processes when the listening environment is more perceptually demanding. Such findings may be clinically useful with respect to assessing hearing loss in parallel with cognitive functioning to improve the communicative experience of those who endure age-related hearing loss.

### Poster 23

**Presenter: Alycia Colunga**

Mentor: Ambreen Khan (Population Health Sciences)

*Hereditary Cancer Risks in Adolescent and Young Adults*

Individuals aged 15 to 39 years at the time of initial cancer diagnosis are defined as the affected adolescent and young adult (aAYA) population. Although AYAs make up a significant portion of Utah's population, little is known about the knowledge base of this group regarding their family history of hereditary cancer. Genetic counselors are healthcare professionals working with patients and other healthcare providers to assess risk of inherited cancers in an individual and/or their family. The aim of this study was to assess aAYAs knowledge about hereditary cancer risk so that future interventions connecting genetic counselors with aAYAs can be developed. The Family Cancer Assessment Clinic at Huntsman Cancer Institute developed tools to help create awareness among AYAs about their family history and genetic counseling options, with the goal of increasing access to genetic testing in this underserved population. Due to the AYA population's unique needs, we have taken into consideration the demand for innovative models to better reach them. To address this, we developed a pre-and post-survey and an educational video that discussed hereditary cancer risks and why genetic counseling is important. A

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total of 151 participants were contacted via telephone. Of those, 76 people were reached. There were 11 that did not want to take part in the study, which led to a total of 65 participants answering the pre-survey. From those 65, 43 agreed to watch the video, however only 6 participants completed the post-survey. One of the major challenges that was faced during this research project was the difficulties faced during the retention process. Overall, many did not answer, want to participate, or be a part of the second half of the study. But based on the data that was gathered, it can be concluded that digital tools did prove to have an impact on the AYA population when communicating health related information. Future studies can focus on trying additional digital tools that appeal to AYAs in order to see which tool may have the greatest impact in reaching this population.

### Poster 24

**Presenter: Fernanda Costilla Correa** (Jackson Hole High School)

Mentor: Nicola Camp (Internal Medicine)

*Gene Expression in Malignant Chronic Lymphocytic Leukemia Cells and Clinical Outcomes*

Chronic Lymphocytic Leukemia (CLL) is a malignancy of B lymphocytes with an incidence of 4.7/100,000 new cases per year. CLL is one of the more common adult-onset hematological malignancies. Around 200 thousand people in the USA live with CLL. Better methods to identify patients in need of therapies is a clinical 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 variables, called "spectra". Spectra variables can be used in statistical modeling to identify high-risk groups.

Transcriptome data from 257 CLL patients attending the Huntsman Cancer Hospital was used to derive 22 CLL spectra describing CLL malignant cells. Each patient has their unique set of CLL spectra values (spectra "barcode"). Similarities and differences in patients can be visualized with barcodes. Descriptive modeling showed spectra could identify known clinical risk markers (IGHV mutation status). Predictive modeling using spectra identified risk groups for survival. In this way, a patient's tumor transcriptome predicts whether they are at high-risk to progress or to die sooner.

To replicate our findings, we are collecting and processing biological samples from more CLL patients from Huntsman Cancer Hospital. We collect peripheral blood and cell-sort to identify malignant cells (CD19+/CD5+). RNA is extracted from these cells and sequenced to generate transcriptome data and the spectra calculated. Non-malignant cells from the cell-sorting procedure are used to extract normal DNA.

The SPECTRA technique provides a more complete understanding of CLL by better characterizing the malignancy. Each spectra is a different tumor characteristic. Our future research includes investigation of whether inherited variations (in normal DNA) are associated with particular CLL spectra or other characteristics of CLL with the ultimate goal of early detection and prevention efforts. We are also pursuing the SPECTRA technique in several other cancers.

### Poster 25

**Presenter: Deanine Dilworth** (Amherst College)

Mentor: Christopher Gregg (Neurobiology & Anatomy)

*Identifying hypothalamic metabolism-associated regulatory regions contributing to Alzheimer's disease pathology*

Alzheimer's Disease (AD), the most common form of dementia, is a neurodegenerative disease affecting many regions of the brain, including cognitive, autonomic, and pituitary functions. Notably, the metabolic pathways controlled by the hypothalamus are dysregulated early in AD. The regulatory regions, cis-regulatory elements (CREs), involved in these pathways have yet to be identified. A 72-hour fasting regimen in wild-type mice causes large scale changes to metabolism, allowing the identification of gene regulatory systems involved. Preliminary RNA-seq data shows large-scale transcriptome changes in the hypothalamus of fasted mice. Our project will define the metabolic and AD-associated hypothalamic CREs by looking at epigenetic changes in fasted wild-type mice and the AD mouse model, 5XFAD mice, respectively. We have optimized OMNI-ATAC-seq for mouse hypothalamus tissue, improving both our nuclei isolation and transposase efficiency. We use this optimized method to identify regulatory regions within the wild-type hypothalamus impacted by fasting and compare this to RNA-seq data to identify metabolically relevant CREs. We also use this approach to identify metabolic CREs and regulatory pathways involved in recovery from fasting via refeeding experiments. Repetition of this in 5XFAD mice at different ages will allow identification of CREs sharing involvement in metabolism and AD pathways. In the future, we will functionally investigate the effects of silencing identified CREs and monitor phenotypic changes in 5XFAD and fasted wild-type mice. Identification of these CREs and their associated pathways will open a gateway to understanding the relevant metabolic pathways, novel drug targets, and improved AD treatments.

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### Poster 26

**Presenter: Dallin Dodge** (University of Utah)

Mentor: Ganesh Adluru (Radiology & Imaging Sciences)

*Automated T1 Analysis of Myocardial Ischemia*

The spin lattice relaxation time in magnetic resonance (T1) has been shown in recent advancements to more effectively analyze myocardial tissue. As such, recent publications have shown increased accuracy in imaging the myocardium through deep learning. Other software exists that currently analyzes the cardiac images such as strain. However, there is no software that performs T1 mapping analysis accurately or without significant time to process the images. Through deep learning and other novel digital image processing techniques, we created software to automate the analysis of T1 weighted images. This analysis includes identifying the cardiac tissue, segmenting the myocardium, and performing a quantitative analysis of relaxation times in order to diagnose cardiac ischemia.

### Poster 27

**Presenter: Nisha Fletcher** (Southern Utah University)

Mentor: Huiwen Ji (Materials Science and Engineering)

*Visualizing Crystal Structures Using Augmented Reality*

Visualizing crystal structures is hard to do when you're only given a 2D image. The solution that we found is to create an app that will use Augmented Reality and image tracking software to impose a 3D model of a crystal structure "on top" of its 2D counterpart. Crystal Aspect, which is the name of the app, does just that. Crystal Aspect is a learning tool that will be used to facilitate classroom study and make learning about crystal structures easier and more accessible. Along with creating an already-made app that anyone can use without any work, we also want to provide detailed instructions on how to create an app like Crystal Aspect, where any form of 3D structure can be modeled.

### Poster 28

**Presenter: Alejandra Garcia** (Florida State University)

Mentor: John Horel (Atmospheric Sciences)

*Case Study Of Variation In Ozone In The Farmington Bay Region During Summer 2022*

Ozone concentrations near the Great Salt Lake's Farmington Bay within Davis County were observed to be higher than in other areas of the Wasatch Front metropolitan region during the summer of 2015. To examine the possible causes for the higher concentrations in that region, ozone concentration measurements at the Utah Division of Air Quality and University of Utah sites along the Wasatch Front during summer 2022 were supplemented at three additional sites: (1) on the exposed dry lakebed of Farmington Bay; (2) within the wetland region on the southern fringe of Farmington Bay; and (3) on the eastern fringe of the Farmington Bay wetlands. Ozone concentrations measured every 5-60 minutes at these and other preexisting sites were related to variations in meteorological and radiative (total solar and ultraviolet) conditions based on additional sensors deployed at the first two sites and other sensors available throughout the region. Variations in photochemical production of ozone due to changes in reflected radiation from the underlying surface on the exposed lakebed have been examined. Wind shifts associated with local mountain valley and land breeze circulations have also been examined to assess the impact of transport of ozone precursors (volatile organic compounds and nitrogen oxides) over the Bay during the morning and lake breezes in the afternoon that transport ozone back towards metropolitan areas. While frequent strong southerly synoptic-scale winds kept ozone concentrations lower throughout the early summer than during summer 2015, periods of high ozone concentrations were observed during late June and early-mid July. Occasional rainfall events significantly lowered the albedo over the exposed lakebed, potentially affecting the production of ozone after these events. The efforts of this study highlight the environmental variables that may be associated with the higher levels of ozone observed earlier in the Farmington Bay region.

### Poster 29

**Presenter: Jackie Gomez** (University of Utah)

Mentor: Jim VanDerslice (Family & Preventative Medicine)

*Historical Road Traffic over Time*

Roads and traffic are constantly monitored for accidents, delays, or conditions of the road after a storm. While studying present roads is crucial, historical road traffic can reveal early life exposures. Studying environmental exposures during early life while using historic traffic data can help us gain a further understanding of how changes in traffic and the development of roads. In this study, we used historic data from historical records of roads and traffic and geocoded these documents into ArcMap Pro. Using this software, we then created a timelapse of each decade from the 1940s to the 2000s, comprising of the historical data.

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### Poster 30

**Presenter: James Gustat** (California Polytechnic State University - San Luis Obispo)

Mentor: Shawn Owen (Pharmaceutics & Pharmaceutical Chemistry)

*Using Computational Modeling to Evaluate Potential HER2-Targeting Antibodies*

Overexpression of human epidermal growth factor receptor 2 (HER2) receptors is prevalent in cancerous breast cells and is a major target for antibody-based therapies. Antibodies have the potential to elicit new mechanisms of action. For example, antibodies that are bispecific and can bind to non-overlapping epitopes of the HER2 homodimer can cause HER2 receptor clustering, leading to possible internalization and improved delivery of anticancer drugs. Screening for potential high affinity HER2-targeting antibodies, obtaining structure, producing quantities for empirical testing, and determining binding epitope, is time-consuming and resource-intensive. The use of phage display and computational methods allows for efficient sampling, screening, and structural prediction of candidate antibodies that can be used for targeting HER2. Phage display allows for the creation of a phage antibody library that contains millions of potential binders that can be tested for their selectivity for an antigen. Computational methods allow for the theoretical determination of structures and interactions between proteins using protein folding programs and protein docking tools. We demonstrate this process on emerging anti-HER2 antibodies and establish a protocol to evaluate additional candidates. Predicting protein characteristics *in silico* can be used as a guide for identifying promising antibodies and prioritizing candidates for empirical testing.

### Poster 31

**Presenter: Ella Habbeshaw** (University of Utah), Emily D. Woodruff

Mentor: Kristen Kwan (Human Genetics)

*Understanding the Cellular Mechanisms of Cornea and Iris Morphology*

The cornea and iris are important for visual acuity, and malformations can cause visual impairments. Both cornea and iris are made up of multiple tissue layers and improper formation of these is a characteristic of Axenfeld-Rieger syndrome (ARS), a congenital syndrome caused by genetic mutations in *pitx2*. Despite the importance of the cornea and iris and relevance to human ocular disease, little is known about how they are formed. To understand the cellular mechanisms underlying tissue assembly in the developing cornea and iris, I used a transgenic zebrafish line (*bactin2:EGFP-CAAX*) and confocal microscopy to visualize tissue formation with cellular resolution. I quantified cell proliferation and cell death using antibody staining at multiple developmental stages (30-120 hours post fertilization) and compared the wild-type to the *pitx2* mutant to determine whether cell proliferation or apoptosis might be affected in this zebrafish model of ARS. In wild-type zebrafish, I found few cells proliferating in the developing cornea, however, I detected more proliferating cells in the developing iris. In the *pitx2* mutant, similarly, I detected few mitoses in the cornea and comparatively more in the iris, however, there are temporal differences in proliferation in the *pitx2* mutant iris compared to wild-type, suggesting that *pitx2* may disrupt the timing of proliferation. Results of the apoptosis experiments show that there are few to no apoptotic cells during the development of either the cornea or iris in both wild-type and *pitx2* embryos. Taken together, my results suggest that loss of *pitx2* may disrupt proliferation in the developing iris but not the cornea, and it is unlikely to affect apoptosis in either tissue. In addition to cell proliferation and apoptosis, other cellular processes are likely to contribute to cornea and iris morphogenesis, including cell migration and cell shape changes; these are the focus of ongoing and future studies.

### Poster 32

**Presenter: Ellie Han** (Vanderbilt)

Mentor: Joseph Kim (Psychiatry)

*How Negative Do You Feel?: Emotion Regulation in aMCI and the Aging Brain*

Reappraisal-based emotion regulation refers to a cognitive process used to willfully control the intensity of emotions we experience. Previous literature suggests that cognitive decline may reduce the proportion of successful re appraisers in MCI patients. This study aims to compare emotion regulation in healthy, neurologically normal older adults and those with memory impairments (amnesic Mild Cognitive Impairment or aMCI). We hypothesized that the aMCI group will show weaker emotion regulation effectiveness as well as worse memory and thinking skills. Older adults, aged 55-79, received a neuropsychological assessment of multiple cognitive domains including memory, and executive functioning. All participants also completed an Emotion Regulation Task (ERT) while undergoing a brain scan (functional Magnetic Resonance Imaging or fMRI). The ERT required participants to maintain, or reappraise their negative emotions while viewing negative images (e.g., gore, violence, or contamination), and subsequently rate how negative they were feeling. A linear fixed effects model was conducted to examine the relationship between age, group and instruction with ERT negativity ratings. As expected, the aMCI group performed significantly worse in the neuropsychological assessment. A Linear Regression showed that there is a significant relationship between negativity rating following “reappraise” and performance on Trail Making Test B. The linear fixed effects model showed that there is no significant relationship between age, group, and the groups’ interaction with instructions, and ERT response values. However, the type of instruction had a significant impact on response values in both groups ( $F(1,17) = 105.1342, p < .05$ ). Furthermore, a paired sample t-test within each group showed that there was a significant difference in the response values following the instructions “maintain” vs “reappraise” in the healthy control group ( $t = -2.25, df = 14, P = 0.041$ ) but not the aMCI group. Despite the small sample size, this study demonstrates the need for subsequent studies on the relationship between cognitive decline in aMCI and emotion regulation.

**Poster 33**

**Presenter: Hannah Hardin** (University of Idaho)

Mentor: Valerie Vaughn (Internal Medicine)

*Creating a Comprehensive Survey to Assess Antibiotic Overuse*

Antibiotic overuse is a multifaceted problem caused by unnecessary antibiotic treatment (e.g., treating viral infections), suboptimal antibiotic use (e.g., fluoroquinolone prescription without indication), and excessive antibiotic duration (e.g., antibiotic treatment for more than 5 days without indication). Antibiotic overuse in hospitals is common and costly, where the potential risks often outweigh the benefits, leading to potential adverse events including longer hospital stays, *Clostridium difficile* colitis, and antibiotic resistance. To inform improvement of antibiotic use, it is imperative to have a standardized way of measuring overuse. We created a survey that indicates cases of antibiotic overuse with the two most common bacterial infectious diseases treated during hospitalization, pneumonia and urinary tract infection. Because antibiotic use and infectious disease are complex and follow different clinical courses, it is important that our method for measuring antibiotic overuse be generalizable and accurate. Feasibility of the measurement tool is an important consideration to continue research of antibiotic overuse. Previous research provided databases on REDCap software that we reconciled to create a new survey, giving us the ability to assess the appropriateness, duration, and optimal use of antibiotic treatment. After narrowing the variables that are most important to assessing antibiotic overuse, a new data dictionary for the survey was created that it is well-defined for abstractors. We gathered information on personal medical history, signs and symptoms consistent with infection, comorbidities, imaging and lab results, antibiotic information, outcomes, and assessment of appropriateness. To assess reliability of the survey, the final determination of appropriate use versus overuse was compared to findings for the same cases in prior studies. The kappa statistic provides a measure of the inter-rater reliability of the survey. After creating a metric that is consistent and accurate, it will be accessible for future research focused on antibiotic overuse.

**Poster 34**

**Presenter: Nicholas Hardy** (Montana State University)

Mentor: Swomitra Mohanty (Chemical Engineering)

*Testing for Tuberculosis Using Electroactive Solutions*

Tuberculosis is one of the deadliest diseases in the world killing about 16% of the infected people; around 95% of those deaths occur in third world countries where testing is expensive and difficult. A rapid, cheap, and convenient method for testing tuberculosis is proposed. Active pulmonary tuberculosis produces methyl nicotinate as a potential biomarker in the breath of infected patients. An electroactive solution containing specific transition metals of a specific valence state can be used to test for this biomarker, as seen in previous studies. This can be done by observing an electrochemical change when mixing breath condensate with an electroactive solution. Two different transition metals, copper(II) and cobalt(II), were used in the electroactive solutions at several concentrations alongside square wave voltammetry to see the effects of a present biomarker. It was found that the square wave voltammogram of copper(II) has a significant change with small amounts of methyl nicotinate, but volatile organic compounds in breath also effect the results. It was also found that the square wave voltammogram of cobalt(II) has a small change with methyl nicotinate present. Copper(II) displays three peaks whereas cobalt(II) displays two peaks during square wave voltammetry, both tests were completed under 2 minutes. Both the height and location of the peaks are effected by present methyl nicotin ate which suggests a reaction taking place between the transition metal and biomarker. Once more is known about the reaction and how volatile organic compounds in breath effect the electroactive solution, a method for testing by comparing healthy vs. infected square wave voltammograms can be used.

**Poster 35**

**Presenter: Jacob High** (University of Utah)

Mentor: Michael Scarpulla (Electrical and Computer Engineering)

*Reduction of Free Charge Carriers by Compensating Defects in Sn-Doped  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>*

Gallium Oxide (Ga<sub>2</sub>O<sub>3</sub>) is a promising material for high-power semiconductor devices due to its unique electrical and material properties that allow for greater efficiency and the ability to handle high voltages and electric fields. Defects and dopants play a crucial role in semiconductor devices, and a thorough understanding of their behavior is necessary for the successful application of the material. In this study, single crystal  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>:Sn is annealed in a pure oxygen environment in order to identify mechanisms that result in a reduction of free charge carriers via the compensation of shallow donor defects in the conduction band. This compensation results in the addition of lower energy states that accept free carriers. To explore this, Fourier-transform infrared spectroscopy (FTIR) was performed to track the change in transmission of the sample at different times during the annealing process. The higher transmittance as annealing time increases indicated a reduction in absorption as the concentration of charge carriers decreased. The experimental data was combined with a computational model to identify possible defect compensation effects that occur during the oxygen annealing. Additional testing with different partial pressures of oxygen, temperatures, and crystal orientations is needed to further analyze the behavior with an end goal of developing a way to prevent this loss of charge carriers during the annealing process.



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### Poster 36

**Presenter: Jake Hirst** (University of Utah)

Mentor: Hoahan Zhang (Mechanical Engineering)

*Study Manual Control Of A Continuum Soft Manipulator*

Due to their highly flexible structures, continuum manipulators (CM) are uniquely suited for many tasks (e.g., surgery, inspection) beyond the capabilities of traditional manipulators. We developed a CM whose shape can be controlled by pulling 3 cables routed through its segments. Due to the under-actuated nature of this manipulator, controlling its shape automatically with motors turns out to be a complex mathematical problem. In this project, we want to study how humans manually control the shape of CM and develop algorithms to emulate their behavior algorithmically. As a first step, we built a manual control system and collected data from human volunteers. This manual system consists of three identical units, each is responsible for pulling one cable by a user. Each unit contains a crank, a pulley, and an encoder to allow a user to interact with the system. A preliminary data collection is performed with 3 volunteers. The testers were asked to control the tip of the CM to reach three target positions. VICON motion capture tracked the position of the CM in 3D space as it moved from one position to another. Simultaneously, the encoder values from the manual system were recorded. We first used a machine learning toolbox to perform symbolic regression to map the cable lengths (measured by the encoders) with the 3D trajectories of the CM (measured by cameras). Future work will then refine the machine learning model to best mimic the behaviors that the human operators exhibit.

### Poster 37

**Presenter: Hailey Hollins** (University of Utah)

Mentor: James Gagnon (School of Biological Sciences)

*An embryonic-like cardiomyocyte subpopulation present in regenerating hearts*

The robust regenerative capability of the zebrafish heart has been extensively investigated, but the characteristics that distinguish zebrafish from species that cannot regenerate their hearts are still unclear. To begin to understand these differences, we used single-cell RNA sequencing and imaging to compare hearts from zebrafish and Japanese medaka, a teleost species with similar heart morphology but that cannot regenerate. We found that adult zebrafish maintain a subpopulation of cardiomyocytes in the primordial myocardium that expresses an embryonic-like gene program. These genes are highly expressed in the developing heart and are correlated with transient regenerative capabilities in neonatal mammals. In contrast to the zebrafish, the non-regenerating adult Japanese medaka lacks this layer of embryonic-like cardiomyocytes. We are further characterizing this subpopulation and its presence in other vertebrates. These findings suggest that cardiomyocyte subpopulations are dynamically gained and lost during teleost evolution and that they may determine regenerative potential.

### Poster 38

**Presenter: Belize Iteriteka** (Bates College)

Mentor: Kristen Kwan (Human Genetics)

*The role of PITX2 in cornea development in Axenfeld-Rieger Syndrome*

Axenfeld-Rieger syndrome (ARS) is a congenital disorder that leads to ocular anomalies in the anterior part of the eye, especially the cornea and iris, that can adversely affect vision. This autosomal dominant syndrome is linked to mutations in *Pitx2*. *Pitx2* is a conserved homeodomain transcription factor that is important for the formation of numerous structures during embryonic development, including the eyes, teeth, and heart. Axenfeld-Rieger syndrome treatments remain limited to managing individual symptoms due to an incomplete understanding of the underlying developmental defects. Mutation of the *Pitx2* gene causes a range of ocular symptoms that can include a cloudy cornea, an incompletely formed iris, and a displaced pupil. Although we know that the human cornea is affected in ARS, we do not understand what has gone wrong during cornea formation. To this end, we are characterizing the cornea in a zebrafish model of ARS in which the *pitx2* gene is mutated. Specifically, we are examining the spatiotemporal expression of tissue-specific molecular markers during cornea development using antibody staining. Our preliminary data show localization of KRT19 in the corneal epithelium and ALDH1A2 in the corneal endothelium at 4 and 5 days post fertilization, a relatively late stage in eye development when corneal tissues are differentiated. Examination of the expression of these genes in the *pitx2* mutant will enable us to determine where and when these tissues might be disrupted during cornea development, revealing specific cellular defects in Axenfeld-Rieger Syndrome.

### Poster 39

**Presenter: Jake Jackson** (Brigham Young University)

Mentor: Xing Li (Radiation Oncology)

*Investigating the Advantages of 3D Printed Boluses in Radiation Therapy*

Radiation therapy is an important treatment modality for many different types of cancer. One strategy used to improve the efficacy of treatment in certain situations is the use of a bolus. A bolus is a term for a piece of material that is placed over a patient's body. It is placed in an area near the location of treatment in order to deliver a more conformal dose to the prescribed area. In our study, we propose a novel method for addressing these challenges by using a 3D printer to generate a bolus. A printed bolus can produce a more conformal fit the

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material traditionally used. The use of 3D printed boluses can also create a more consistent application and location of the bolus in each appointment.

### Poster 40

**Presenter: Devon Jecmen** (University of Utah)

Mentor: Sara LoTempio (Psychology)

*Nature, Depression, and the Vagus Nerve*

The positive effects of natural environments on mental health have been observed and studied for decades. Specifically, psychology research from across the world has provided evidence that being immersed in nature has positive effects for those suffering from depression, although there is uncertainty about the mechanisms behind this relationship. Research supports frameworks that outline how nature exposure positively affects mental health, such as the biophilia hypothesis (Wilson, 1984), Stress Recovery Theory (Kaplan, 1995) and Attention Restoration Theory (Ulrich et al., 1991). Importantly, research specifically regarding depression supports these theories as well. Scott et al. (2021) proposed that cognitive restoration and stress recovery in nature are indications of stimulation of the vagus nerve. Applying Scott et al.'s (2021) argument to research on nature and depression, this paper argues that activation of the vagus nerve is part of the mechanism by which nature exposure decreases depression. Research on the direct relationship between being in nature and vagal tone in individuals with depression is needed in order to determine if this relationship exists. In an increasingly globalized world, it is vital that this research includes participants and researchers who are from different cultural backgrounds in order to determine that this interaction is present across humans from diverse backgrounds and what socio-cultural influences are not understood currently. Further, this research can not only be applied in the mental health field, but it can also be used in environmental advocacy.

### Poster 41

**Presenter: Acaysha Jones** (Salt Lake Community College)

Mentor: Lilliam Pinzon (Dentistry)

*Efficacy of Caries Treatment with SPF/SDF+AB in Wayuu Population, La Guajira-Colombia*

**Introduction:** Wayuu ethnic group lives inside the Indigenous Reservation of Alta and Media Guajira. This population is lacking access to dental and medical services as well as educational, and technological resources. We are investigating the efficacy of caries treatment with three interventions.

**Methods:** This project is a prospective clinical translational study. Participants were clinically evaluated at baseline. All their caries-affected teeth were treated with single and multiple-surface silver diamine fluoride+ACTIVA BioACTIVE (SDF+AB) or silver polyamine fluoride+ACTIVA BioACTIVE (SPF+AB) restorations at baseline. All restorations will be evaluated at 6-month, 12-month, 18-month and 24-month follow-up visits using a quality evaluation protocol to assess the clinical outcome of each procedure. All participants were and will be provided with oral health counseling and their psychological status was and will be evaluated at baseline and at every follow-up visit. The project will collect treated teeth to evaluate the mechanical, chemical properties and interfacial microstructure.

**Results:** This is ongoing study.

**Conclusion:** This research will allow us to understand the clinical outcomes of the treatments and the remineralization process of the restored teeth. If the results are favorable, these treatments have the potential to impact dental practice, patient management policies, public health, and global health. The inclusion of psychological status and oral health counseling in our study might allow us to demonstrate the relationship between oral and mental health.

**Acknowledgment:** We would like to express our gratitude to Pulpdent, Wayuu community, Juan Guillermo Villegas, Juliana Ocampo, Gracelyn Brito, Doña Gladis for their supports in completing this study

### Poster 42

**Presenter: Eli Jones** (Southern Illinois University, Carbondale)

Mentor: Josh Tang (Chemistry)

*Investigation of Co(I)/Ni(I)-Mediated Oxidative Addition Processes through Electroanalytical Studies*

Oxidative addition involves the insertion of a low-valent metal into an organic substrate. Despite widespread use of oxidative addition in organic synthesis, mechanistic insight on this fundamental organometallic step is still lacking. Our group has developed a platform combining electroanalytical techniques and traditional physical organic analysis for the investigation of Co(I)/Ni(I) oxidative addition mechanisms. Herein, we demonstrate the application of this platform to the study of three catalytically relevant oxidative addition processes: (1) oxidative addition of allyl esters into Co(I)/Ni(I) complexes; (2) oxidative addition of aryl iodides into Ni(I) complexes; and (3) oxidative addition of heteroaryl halides into a Ni(I) complex. In each study, a unified kinetic trend was observed. Through further

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physical organic studies, a precise mechanistic interpretation of these kinetic trends was obtained. These findings demonstrate the potential for our study to guide the rational design of new Ni(I)/Co(I) catalysts.

### Poster 43

**Presenter: Atharva Kamat** (University of Utah)  
Mentor: Jeffrey Bates (Materials Science and Engineering)  
*Polysaccharide-based Superabsorbent Polymers*

Superabsorbent polymers are materials known for their ability to store extraordinary amounts of liquid relative to their mass. Commercially used superabsorbent polymers, such as polyacrylate hydrogels, contaminate the environment because of their abundance in disposable products and inability to biodegrade. This research explored the possibility of polysaccharide-based polymers synthesized with completely nontoxic reagents in order to develop biodegradable polymers for hygiene applications. Chitosan or kappa carrageenan were precipitated out of solution or crosslinked with citric acid or glycerol phosphate disodium and the corresponding absorbency capacity and speed were measured and compared to that of sodium polyacrylate. The samples demonstrated lower performance on both measures.

### Poster 44

**Presenter: Elsie Kearl** (Southern Utah University)  
Mentor: Adam Bress (Population Health Sciences)  
*Association Between Pharmacy Deserts and Risk of Hypertension*

Pharmacies are a critical part of the healthcare system; they provide access to necessary health services, such as the facilitating point of blood pressure measurements for antihypertensive treatments. Reduced access to these services -sometimes referred to as pharmacy deserts- can cause non-adherence to antihypertensive treatment which is associated with increased risk of uncontrolled hypertension. The aim of this study was to determine the association between living in a pharmacy desert and BP control by observing the patients in the REasons for Geographic and Racial Differences in Stroke (REGARDS) Study.

We excluded participants outside the 30 most major U.S. cities and those without hypertension (hypertension being defined as SBP  $\geq$  140 and DBP  $\geq$  90) which resulted in a population of 1,204. Participants were split into two groups- those living in a pharmacy desert and those not- using socioeconomic traits provided at visit two. A prevalence ratio comparing the risk of controlled blood pressure between the two groups was calculated using a Poisson regression model. The resulting ratio with a 95% confidence interval was 1.03 (0.89,1.20). We found no evidence to support an association between residing in a pharmacy desert and uncontrolled hypertension.

### Poster 45

**Presenter: Annie Knapp** (St. Lawrence University)  
Mentor: Michael Morse (Chemistry)  
*Spectroscopic Studies of Transition Metal Nitrides and Carbides*

Transition metals have a wide range of applications in a variety of scientific disciplines. Transition metal nitrides have prompted significant research interest due to their chemical stability, electrical conductivity, and potential for electrochemical energy conversion and storage. Transition metal carbides are mainstays in organometallic chemistry because of their wide range of uses in catalysis and natural product synthesis. Despite the importance of these molecules in various applications, little is known about the fundamental underpinnings of these chemical bonds. In this work, the fundamental bond dissociation energies (BDE) and adiabatic ionization energies (IE) of transition metal carbides and nitrides were studied using resonant two-photon ionization (R2PI) spectroscopy combined with a Wiley–McLaren ion source reflectron time of flight mass spectrometer (TOFMS). Furthermore, the electronic structures of these molecules were investigated using density functional theory (DFT) and *ab initio* quantum chemical calculations. These spectroscopic studies along with the high-level quantum calculations performed in this work allow for an elucidation of the qualitative and quantitative landscape of the chemical bondings in the transition metal nitrides and carbides studied here. An additionally important aspect of this work is that now, for the first time, these mainly unknown fundamental thermochemical properties can be used for benchmarking state-of-the-art quantum chemical methodologies for further development of technological applications of metal nitride and carbide containing species.

### Poster 46

**Presenter: Kristie Kulbeth**  
Mentor: Erik Hughes (Chemistry)  
*Investigating the effect of the transcriptional coactivator OCAB/Pou2af1 in the development and strength of Multiple sclerosis.*

Multiple Sclerosis (MS) is a debilitating autoimmune disease, mediated by CD4 T cells, that currently affects over 2.8 million people globally. Many therapeutic treatments for multiple sclerosis leave the patient immunosuppressed and at risk of opportunistic infection. Therefore, there remains an unmet need for new therapeutics that can limit disease while maintaining immune functionality.

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The transcription factor Oct1 along with its transcriptional coactivator, OCA-B, regulate key cytokines and transcription factors for Th1 and Th17 CD4 T cells, known drivers of autoimmune demyelination. The Tantin lab has shown in a mouse model of MS that knocking out Oct1 in CD4 T cells reduces autoimmune demyelination while maintaining the ability for neurotropic virus clearance. Oct1, however, is a poor therapeutic target because of its ubiquitous expression. OCA-B's features and lymphocyte-restricted expression makes it a much easier potential therapeutic target. Unpublished work in the lab has shown that the loss of OCA-B in CD4 T cells is protective in multiple mouse models of MS. However, it is currently unknown whether or not OCA-B expression alone in CD4 T cells is sufficient to cause disease.

To test this, the Tantin lab utilized CRISPR/Cas9 to generate mice with multiple mCherry elements under the control of OCA-B expression. Using these OCA-B reporter mice, we initiated an adoptive transfer pilot experiment to test if only cells that express OCA-B preferentially transfer demyelinating diseases. We found higher clinical scores in the mouse that was given OCA-B expressing CD4 T cells compared to the mouse who was given CD4 T cells lacking OCA-B expression.

To further these experiments and eliminate confounding effects of TCR specificity, we crossed the OCA-B reporter mouse allele to the 2D2 transgenic mouse, so that all CD4 T cells present will be specific to the myelin peptide fragment MOG35-55. Future work will continue these experiments with more mice to ensure that the difference that we saw was significant.

### Poster 47

**Presenter: Ananya Kumar** (University of Texas at Austin)

Mentor: Shreya Goel (Pharmaceutics & Pharmaceutical Chemistry)

*Evaluations of Pazopanib Efficacy on Pediatric Sarcoma Cell Lines*

Sarcomas are cancerous tumors usually located in soft tissues and often affect pediatric patients. Despite the large amount of research surrounding cancer, there is little research pertaining to such pediatric cancers due to their rarity. Efforts are needed to optimize current cancer treatments for pediatric settings. Pazopanib, a tyrosine kinase inhibitor, is FDA approved for various adult malignancies and is in clinical trials for pediatric sarcomas. However, it has been noted that not all patients respond to pazopanib, and many patients can develop resistance. In this project, we sought to determine the efficacy of pazopanib on two sarcoma cell lines – A-204 rhabdoid tumor and SaOS-2 osteosarcoma – using in vitro cytotoxicity assays. Cells were treated with the drug at various concentrations. Cell viability was determined using the CCK-8 assay and spectrophotometry to calculate the IC<sub>50</sub> values. The results of this assay indicate that the IC<sub>50</sub> value for A-204 cells is 1.31  $\mu\text{M}$  while that of SaOS-2 cells is 106.60  $\mu\text{M}$ , supporting the initial hypothesis that A-204 cells are more sensitive to pazopanib than SaOS-2 cells. A clonogenic assay was also performed to determine the aggressiveness of A-204 cells in response to pazopanib in a dose-dependent manner. The assay used crystal violet staining to observe the colony formation of the cells. From the quantitative result of the number of colonies formed as well as the qualitative result of the image of the stained colonies, it is evident that administering increasing concentrations of pazopanib does affect the aggressiveness of the cells compared to that of the control. This data further confirms the sensitivity of A-204 cells to pazopanib. These tests lay the foundation for future in vivo studies, where imaging biomarkers will be used to identify if a tumor will respond to pazopanib and determine the onset of resistance.

### Poster 48

**Presenter: Evan LaForge** (University of Arizona)

Mentor: Ramón Barthelemy (Physics & Astronomy)

*Qualitative Social Network Analysis of Women and LGBT+ Professional Physicists*

Part of a successful career trajectory in physics is building and maintaining a professional network of peers, collaborators, and mentors that can support one's self in finding new opportunities and professional growth. This is known to be challenging for marginalized groups, such as women and lesbian, gay, bisexual, and transgender (LGBT) persons, and may be one of the reasons that these groups face challenges in physics. Therefore, there is a need for research on networks of women and LGBT physicists. In this qualitative Social Network Analysis (SNA) study, data is collected through in-depth semi-structured interviews by video conference with participants who are women and/or LGBT, hold a Ph.D. in physics and work in the academic, private, or government sectors. Participants were asked to draw sociograms that provide visual information about personal and professional connections relevant to them. Preliminary findings will be presented.

### Poster 49

**Presenter: Jordy Larrea Rodriguez** (University of Utah)

Mentor: Amy Lenz (Orthopaedics)

*A Pilot Study Replicating Foot and Ankle Kinematics and Kinetics Using a Custom Robotic Simulator*

Conventional *in vivo* foot and ankle models with skin-mounted retroreflective markers are encumbered by inaccuracies related to skin-motion artifact and poor rigid body assumptions, where kinematic contributions of individual bones are lost. These assumptions lead to inaccurate descriptions of specific joint motions observable in lower extremity prosthetic designs and foot and ankle surgery. Although, *in vivo* biplane fluoroscopy studies have demonstrated more accurate individual bone motion tracking, these studies are limited by small

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sample sizes, the heterogeneity of the typical human population, and expensive equipment. Robotic simulators allow for direct kinetic and kinematic measurements *in vitro* while eliminating the heterogeneity of *in vivo* studies, where physiology and morphology vary. The purpose of this pilot study is to develop a simulator for collecting *in vitro* kinetic and kinematic data during plantar-/dorsiflexion, inversion/eversion, and internal/external rotation. Three cadaveric male right tibial plateau-to-toe tip specimens will be procured. Infrared motion tracking markers will be mounted directly to the tibia, fibula, talus, calcaneus, cuboid, and navicular bones. A six-axis robotic manipulator will position the specimen over three load cells to measure forces and moments under the first and fifth rays and heel while manipulating the foot and ankle through the prescribed motions. Kinetic and kinematic data will be collected in sync using a custom LabVIEW program. Findings from this study will provide a better understanding of the tibiotalar, subtalar, calcaneocuboid, talocrural, and talonavicular joint motions; thus, informing future implant development and surgical treatment for the foot and ankle.

### Poster 50

**Presenter: Zach Eatough** (University of Utah)

Mentor: Amy Lenz (Orthopaedics)

*Quantitative Modeling To Evaluate Varus Ankle Osteoarthritis*

**INTRODUCTION:** Patients with advanced ankle osteoarthritis (OA) often present with limited physical function, severe pain, and diminished quality of life. The bones of the hindfoot; tibia, talus, and calcaneus can orient in several ways following the onset of OA, complicating diagnosis and treatment. High-resolution weight-bearing CT scans provide a more complete understanding of the joints by allowing 3D visualization. Statistical shape models (SSM) can be constructed from WBCT image data to quantify and compare shape across time and/or between groups.

**METHODS:** 20 participants with symptomatic advanced varus ankle OA underwent WBCT scans with IRB approval. Bonelogic 2.0 from Disior & Mimics Innovative Suite from Materialise were used to complete bone segmentations. Shapeworks Studio from the Scientific Computing and Imaging Institute at The University of Utah was used to compute statistical shape models and compare group differences.

**RESULTS:** The 3D bone reconstructions illustrate osteophyte growth and narrowed distance throughout the tibiotalar, subtalar, talofibular, and tibiofibular joints indicative of advanced ankle OA. Observations regarding alignment of talonavicular and calcaneocuboid joint are also notable.

**DISCUSSION:** These results could be used to better diagnosis and treatment of pathological ankles improving patient outcomes. By increasing our understanding of ankle OA progression earlier diagnosis of OA is possible and can influence clinical decisions such as preventative care and surgery.

### Poster 51

**Presenter: Diego Lazaro** (University of Utah)

Mentor: Anne Kirchhoff (Pediatrics)

*Testing a brochure about a health insurance education program for Utah's Hispanic/Latinx community*

**Background:** The Utah Health Policy Project (UHPP) has a program where they help people enroll in health insurance coverage through either Medicaid or the insurance marketplace. We describe a research study that was conducted to understand UHPP clients' knowledge of health insurance. The goal is to design educational materials on health insurance for UHPP clients.

**Methods:** Our research team held interviews with 21 UHPP clients. Then we analyzed the interviews. Based in the interviews findings we made a brochure to share results with the UHPP team on topics such as areas of confusion on health insurance. We have sent a survey with the brochure to the UHPP employees as well as other research staff to get feedback (N=21). Data collection is ongoing.

**Results:** Currently, 13 of 21 people responded to the survey; of these, 15% were UHPP employees and 84% were research staff. Most participants thought the brochure was understandable (1=not understandable to 5=understandable, mean=4.57). Participants thought the material was useful (53% very useful; 46% mostly useful). Participants thought the information was helpful (88% yes; 11% no). Most participants liked the brochure overall (69% easy to understand; 23% number of visuals; 69% sufficient information; 69% accessible language; 23% resources given). Some participants reported that the visuals were not pleasing (23%), others specified there were not enough resources (7%).

**Conclusion:** Our findings show that community resources like UHPP work well with research teams and can positively have an impact on community members and helping them getting set up on health insurance. Researchers and UHPP staff appreciate receiving the results through our brochure. We anticipate that the program could have a positive impact on community members.



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### Poster 52

**Presenter: Dani Lehto** (University of Wisconsin-Eau Claire)

Mentor: Shelley Minteer (Chemistry)

*Bipolar Redox-Active Organic Molecules for Symmetric Non-Aqueous Redox Flow Batteries*

The energy efficient and cost efficient large-scale energy storage devices are pertinent to improving grid use of renewable energies such as wind and solar power. Developing flow batteries of cost and energy efficiency are central to this purpose, they are scalable and capable of storing intermittent renewable energy. Organic non-aqueous redox flow batteries (O-NRFBs) employ organic molecules capable of acting as an electron donor and electron acceptor as the anolyte and catholyte battery terminals, respectively. The organic solvents used in O-NRFBs show promise in a wider potential window than of aqueous flow battery systems. Challenges facing O-NRFBs is the fading battery capacity following cross-over of molecules from the catholyte and anolyte terminals, causing side reactions and loss of redox behavior. In this work, benzothiadiazole based bipolar redox active molecules are synthesized and studied to mitigate cross-over, where the bipolar molecule acts symmetrically as both the anolyte and catholyte in this system. The two electrons cathodic peak and the two different two electron anodic peaks led to a promising cell voltage of ~3 V. The covalent crosslinking of electron acceptor and donor molecules proposes an alternative for designing organic redox active materials for O-NRFBs.

### Poster 53

**Presenter: David Lempke** (Other: Michigan State University)

Mentor: Eric Montoya (Physics & Astronomy)

*The effects of granular media on spin Hall effect nanowire oscillators*

Spin-orbit torques in bilayers of ferromagnetic and heavy metal materials hold promise for energy-efficient nanodevices. Spin Hall oscillators (SHOs) can allow for compact, tunable sources of microwaves. Recent experiments have demonstrated that nominally identical nanowire SHOs display different critical currents and emission spectra. Spin torque Ferromagnetic Resonance (FMR) measurements have also revealed different spatial mode structures among nominally identical nanowires. Here, we investigate the role that granular disorder plays in ferromagnetic nanowires. Using Mumax3 micromagnetic simulation software with experimentally determined material parameters we explore how small anisotropy variations and reduced exchange coupling between grains give rise to these unexpected phenomena. Our results show that slight changes in the granular disorder of nanowire SHOs can produce vastly different results for the frequencies, amplitudes, and spatial distribution of oscillatory modes. We find that grain size, anisotropy variation, and weakened intergrain exchange coupling can significantly alter nanodevice performance.

### Poster 54

**Presenter: Annette Lewis** (University of Utah)

Mentor: Martin Tristani-Firouzi (Pediatrics)

*NFATC1 regulation of the expression of proteins relevant to atrial excitability*

Atrial fibrillation (AF) is the most common type of clinical arrhythmia, affecting up to 5% of adults > 65 years old. Young-onset AF refers to individuals < 60 years of age and has a strong genetic component. We have previously described a family with young-onset AF phenotype that segregated with a mutation in the Nuclear Factor of Activated T Cells 1 (*NFATC1*) gene. NFATC1 is a calcium-dependent transcription factor that has not been previously linked to cardiac excitability. We hypothesize that NFATC1 regulates the expression of genes relevant to atrial excitability, thereby providing the substrate for AF. To test our hypothesis, we used an atrial murine cell line (HL-1), where the expression of the *nfatc1* gene has been silenced by transfection with silencing RNA. After transfection, we probed for proteins relevant to atrial function and excitability (ionic channels and transporters, calcium regulation, etc.) using Western blot protocol. Our preliminary results suggest that sarcolipin, an atrial specific regulator of calcium homeostasis, is downregulated when *nfatc1* has been silenced. We will further characterize other targets and we expect that the level of expression of some of these proteins will also be modified by *nfatc1* silencing. These results would identify proteins relevant to atrial excitability that are regulated by *nfatc1*. This information could potentially shed light on the mechanism behind the development of AF. Future directions will include exploring functional changes in silencing HL-1 cells that occur due to the modification of the protein expression.

### Poster 55

**Presenter: Alyssa Lopez** (University of Kentucky)

Mentor: Anna Parks (Internal Medicine)

*Development and Validation of a Novel Patient-Reported Outcome Measure for Bleeding Quality of Life in Older Adults*

Anticoagulants prevent thromboembolic stroke in atrial fibrillation (AF) and treat venous thromboembolism (VTE) but at the expense of increased bleeding risk. Current definitions of bleeding events underrepresent older adults' experience of bleeding and do not capture many minor bleeding events. In hematology, there is a lack of patient-centered measures on the effect of anticoagulant-related bleeding on quality of life (QoL) in older adults. Since few studies incorporate patient-centered goals, providers and patients face challenges in applying evidence and recommendations for treatment. Creating a patient reported outcome measure (PROM) related to minor bleeding events can help clinicians and other researchers create a better understanding of the QoL in older adults taking anticoagulants with AF and/or VTE.

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This presentation will summarize the efforts already made towards creating a questionnaire about measuring the QoL in elderly patients taking anticoagulants for AF and/or VTE. This includes part one of the project where focus groups were conducted to refine a conceptual model that forms the basis for developing the PROM. Using this information, a pilot questionnaire has been created that will be given to 20-30 participants through cognitive interviews. After receiving this feedback, the questionnaire will then be revised, where items may be eliminated to then go through a multi-step process including expert review to create the final questionnaire. We hypothesize that this novel measure will better characterize older adults' experience of bleeding than existing measures. This is the first step toward incorporating the voice of older adults into our understanding of bleeding on anticoagulants.

### Poster 56

**Presenter: Andrew Bergenthal** (University of Utah)

Mentor: Sameer Patil (School of Computing)

*Comparing Two-factor Authentication Deployment Options Across Organizations*

Two-factor authentication has become increasingly prominent in the university setting, where the mechanism protects almost all university resources pertaining to user accounts. While important for enhanced security, two-factor authentication can degrade user experience (UX) and decrease productivity. Various implementation options can help achieve a reasonable balance between security and UX. However, there has not yet been a systematic investigation of how the balance is affected by variations in the implementation option. As the first step toward investigating this aspect, we collected the options provided for the two-factor authentication implementations at nearly 150 American universities of various types and size. In particular, we examined the availability of various mechanisms as the second factor and the period of time for which users can choose to "remember" their authentication before being asked for the second factor again. We found that most universities allow users to remember their two-factor authentication for 30 days in order to reduce user burden for the number of times the second factor needs to be invoked, thus providing better UX for authentication. We plan to administer a large-scale online questionnaire to collect user perceptions of UX across these universities and examine how they might be influenced by the variations in options available to the users.

### Poster 57

**Presenter: Iyanna Lusk** (North Carolina A&T)

Mentor: Brock O'Neil (Oncological Sciences)

*Rural & Urban Opioid Disparities*

**OBJECTIVE:** While rural-urban disparities in opioid misuse outcomes remain largely unknown, the possibility of patients abusing prescription drugs after treatment could result in an overdose, coma, or death. This study aimed to investigate the frequencies of the abuse of opioids between rural and urban prostate cancer survivors in Utah in order to explore any potential rural-urban differences.

**METHODS:** Prostate cancer patients were diagnosed between 2012 and 2017 in the Utah Cancer Registry. Electronic medical records, statewide healthcare facility data, and the Utah All-Payer Claims Database were linked through the Utah Population Database to identify persistent opioid use, which is defined as having at least one opioid prescription >180-360 days after treatment, among rural versus urban prostate cancer patients. Logistic regression was used to estimate the probability of persistent opioid use after treatment, and Cox proportional Hazards models were used to estimate risk of death associated with persistent opioid use among rural versus urban prostate cancer patients.

**RESULTS:** We looked at a total of 6,986 patients. Out of 6,986, 690 were rural and 6,026 were urban. Patients living in small and isolated rural towns may be associated with lower rates of continuous opioid use, however, our data did not show this relationship to be statistically significant (OR, 0.79; 95% CI, 0.50 - 1.26). Large rural cities or towns may be linked with lower rates of ongoing opioid usage in patients, but our data did not statistically support this association. (OR, 0.80; 95% CI, 0.57 - 1.13).

**CONCLUSION:** The results don't seem to indicate why prostate cancer patients in rural areas do worse than those in urban areas. At least, the use of prescription opioids doesn't appear to be the cause of rural patients' worse prognoses for prostate cancer. Future research should concentrate on capturing the potential that illegal opioids explain the difference, but we aren't able to reach that just yet.

### Poster 58

**Presenter: Derk Lyford** (St. Olaf College)

Mentor: Steve Krueger (Atmospheric Sciences)

*Fast Wildfire Simulations in Complex Terrain Using QES-Fire*

The effect of wildfires in the western United States is becoming an increasing threat to human health and infrastructure. Forecasting and predicting wildfires is important to fire management and smoke forecasting, which allows us to predict levels of pollution that have been caused by wildfires. QES-fire is a 3-D fire simulator that uses a parametrized mass-conserving wind solver, simplified rate of spread model, and plume-merging model to couple the atmosphere and fire front. The scope of this project is to observe and quantify the burn behavior of QES-Fire in the presence of complex terrain. We analyze the total burned area with ambient/environmental winds under two idealized types of terrain: a uniform inclined plane, and a normalized gaussian hill.

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### Poster 59

**Presenter: Mansoor** (University of Utah)

Mentor: Justin English (School of Biological Sciences)

*Identify Novel Agonists for Orphan G Protein-Coupled Receptors*

G protein-coupled receptors (GPCRs) are seven-transmembrane signaling proteins that convey extracellular inputs such as light, peptides, metabolites, and odorants into cytoplasmic signaling events. More than 30% of FDA approved drugs target GPCRs. While critical for human health and cellular homeostasis, less than half of the 800 GPCRs encoded in the human genome have been studied and characterized. These understudied GPCRs are referred to as "orphan" receptors because no endogenous or synthetic ligands have been identified for these targets. Without a ligand to selectively probe orphan GPCR function in cells and tissues, these targets have remained unstudied by the scientific community. Identifying ligands for these orphan GPCRs would allow their pharmacology to be characterized and possibly make them excellent drug targets, or lead to other significant pharmaceutical advancements. To deorphanize these understudied receptors, we performed a screen to identify agonists of orphan GPCRs. This screen identified many potential hits across a number of orphan GPCRs. Here, we outline the process by which we will hit-chase these prospective agonists and validate them as selective ligands for orphan GPCRs. This work will ultimately provide the GPCR field with the tools necessary to deorphanize and develop new GPCRs for pharmaceutical development.

### Poster 60

**Presenter: Adamaris Martinez** (University of Utah)

Mentor: Martin McMahon (Dermatology)

*Investigating resistance to drugs that target oncogenic MAPK*

On a global scale in 2020, more than 10 million people died of cancer. Oncogenic signaling through the RAS-regulated RAF>MEK>ERK pathway (also known as the MAPK pathway) drives the initiation and progression of both pancreatic cancer and cutaneous melanoma. The overall goal of this project is to investigate potential mechanisms of resistance to drugs that target this pathway. Our first aim evaluated if CDK4/6 inhibitors induce compensatory autophagy in pancreatic cancer. Previous data from the lab suggest that CDK4/6 inhibition induces autophagy, although we observe no change in the expression of cargo binding proteins. If an increase in autophagy were to be present, there would be a decrease in the expression of cargo-binding proteins. The phosphorylation of AMPK is likely independent of CDK4/6's ability to regulate autophagy. The second aim focused on understanding the biochemical changes that occur when oncogenic BRAF<sup>V600E</sup> is expressed in human melanoma cells. BRAF<sup>V600E</sup> is the most common mutation in cutaneous melanoma, occurring in about 50% of melanomas. Preliminary results show that oncogenic BRAF elutes in a high molecular weight complex through gel filtration chromatography. Additionally, human melanoma cells expressing a drug resistant form of BRAF, p6<sup>BRAF(V600E)</sup>, also elute at this higher molecular weight. Interestingly, when human melanoma cells expressing full-length BRAF<sup>V600E</sup> are treated with the BRAF<sup>V600E</sup> inhibitor vemurafenib for 24 hours, it shifts the elution of BRAF, as well as ERK, as evaluated through gel filtration chromatography. In conclusion, this project has the potential of improving the treatment and prevention of drug resistance in MAPK pathway driven cancers.

### Poster 61

**Presenter: Eliana Massey** (University of Utah)

Mentor: Matthew Basso (History)

*The WWII American Homefront and the Development of the Modern LGBT Movement in the United States: A Case Study in Using Thematic and Place-Based Methodologies in Historical Interpretation for the National Park Service (NPS)*

Concurrent thematic and place-based approaches improve our ability to interpret and interact with the history of the WWII home front. In conversation with NPS historians, our research team developed themes that would shed new light on the World War II home front experience and thereby lead to a richer understanding of the complexities of the period. These themes include the history of sexuality, the environment, disability, and gender, as well as Native American, Filipino American, Chinese American, Mexican American, and Latine communities. By selecting these themes before conducting source searches, we were able to ensure comprehensive and inclusive representation of relevant topics and demographics in our research. We found that a place-based approach, which was critical for our NPS goals, worked well with a thematic approach. Place-based approaches are well received by the public. They further their understanding of the past's relevance to the present in a highly contextual setting. Our team researched the home front history of every state and territory focusing on sites in each place that revealed the new histories the NPS tasked us to illuminate. In the case of the relationship between the WWII home front and the modern LGBT movement in the United States, place-based history shows the importance of sites such as gay bars all over the country and how the war prompted migrations of individuals coupled with an American wartime ideology of freedom, which all too often did not apply to minority communities, shaped the practices and the geographic dispersion of the modern LGBT community.

### Poster 62

**Presenter: Abigail McDonald** (Montana State University)

Mentor: Owen Chan (Internal Medicine)

*Glutamate Release Stimulated by Norepinephrine in the Ventromedial Hypothalamus in Response to Hypoglycemia*

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Recognition of decreasing glucose levels during hypoglycemia is dependent, in part, on glucose-sensing neurons located in the ventromedial hypothalamus (VMH) in the brain. The neurotransmitters norepinephrine and glutamate are supportive in restoring plasma glucose levels by initiating a counterregulatory hormone response. Studies have shown that when norepinephrine and glutamate are released into the VMH in response to hypoglycemia, they bind to B2-adrenergic and kainic acid receptors, activating counterregulatory hormone responses to hypoglycemia. However, the organization of the neural circuitry leading to the release of glutamate is unclear. This study's objective was to clarify the neural circuit(s) involved in hypoglycemia detection and to determine if norepinephrine is required to stimulate glutamate release. Immunohistochemistry was used to examine if B2-adrenergic receptors co-localize with VGlut2, a marker for glutamatergic neurons. Our data shows that B2-adrenergic receptors are expressed on VMH glutamatergic neurons. We then conducted microdialysis studies by infusing norepinephrine into the VMH to evaluate its effects on glutamate and counterregulatory hormone release. Subsequently, we co-delivered norepinephrine and a kainic acid receptor blocker to determine whether norepinephrine-stimulated glutamate release is necessary to trigger counterregulatory hormone secretion. Our data shows that NE stimulates glutamate release in the VMH, which was associated with a rise in both glucagon and epinephrine. Notably, the elevation of glucagon and epinephrine was ablated in the presence of the kainic acid receptor blocker. We, therefore, conclude that glutamatergic neurons are positioned downstream of noradrenergic neurons in the VMH, and norepinephrine-stimulated glutamate release is required to trigger glucagon and epinephrine secretion.

### Poster 63

**Presenter: Derrick McNealy** (Mississippi Gulf Coast Community College)

Mentor: Garrett Brown (Human Genetics)

*Characterization of resistomes in gastrointestinal and respiratory tracts.*

Antimicrobial resistance (AMR) complicating respiratory tract (RT) infections is associated with the deaths of millions annually. The community of microorganisms that colonize the human body, termed the microbiome, has widespread effects on the human health, and notably contains a reservoir of AMR genes, collectively referred to as the resistome. Understanding the characteristics of this system will improve our understanding of AMR in colonizing pathogens. Though horizontal gene transfer occurs between genomes isolated from different body sites, the relationship between the gastrointestinal (GI) tract and respiratory tract (RT) resistomes have not been deeply investigated. To better characterize this relationship, we analyzed a publicly available dataset from the Human Microbiome Project (HMP) to test for similarities and differences between resistomes of samples from the throat and GI tract of healthy humans. Based on this characterization, we then perform further analysis to understand differences in AMR diversity between samples in the same subjects as well as between subjects over time. Our work has the potential to inform how resistance profiles of bacteria in the gut may impact the respiratory tract.

### Poster 64

**Presenter: Alisa Morrell** (Brigham Young University)

Mentor: Vincent Koppelmans (Psychiatry), Brian Mickey, MD, Scott Langenecker, PhD

*Motor Function as a Biomarker for MDD*

Major Depressive Disorder (MDD) is a mental health disorder characterized by long-term depressed moods, loss of motivation, and other symptoms that significantly impair daily life. When left untreated, almost 1 in 5 people with MDD die by suicide, a top 10 leading cause of death in the year 2020.

Current methods for diagnosing depression generally include a series of structured clinical interviews and questionnaires. If an individual shows a certain number of symptoms beyond a determined threshold, they are diagnosed with MDD. From there, different validated treatment options are available, ranging from cognitive therapy and a wide variety of antidepressant medications to electroshock therapy. While these treatments have shown to be effective, roughly half of MDD patients are considered to be resistant to first-line antidepressants. Thus, there is a need for new methods of treating depression. Previous research has linked treatment-resistant depression with impaired motor function, but surprisingly little research has been done to model the relationship between the two. This point is the launch pad of this study.

This project seeks to better understand the relationship between MDD and motor behavioral measures, with the aim of improving diagnosis and treatment outcome of depression. We hypothesize that motor measures in depressed patients will show statistically significant differences from motor measures in control subjects, and that these measures will differentiate control subjects from depressed subjects. In this study, 25 control subjects, of which 17 were female and 8 were male, were tested along with 11 depressed subjects, of which 6 were female and 5 were male. All subjects' mean age was 60. The HVLT-R, BVMT-R, Stroop Word-Color, Trail Making, and grip strength tests, along with a test that required walking while completing a verbal task, were administered to test motor and cognitive skills. Their scores were analyzed for statistical significance. The aim is that the relationship between MDD and motor behavioral measures can be modeled and then used to differentiate controls from depressed subjects, and eventually this project aims to further use these models to identify MDD subgroups including those who are treatment-resistant. This will allow individualized treatment planning for various biotypes and improve the diagnostic process.

**Poster 65**

**Presenter: Cole Nelson** (University of Wyoming)

Mentor: David Belnap (School of Biological Sciences)

*Polyomavirus VP1 Assembly And C-Terminal Tail Interactions*

Polyomavirus contains a major capsid protein (VP1) that forms stable pentamers in low-ionic strength, neutral and alkaline solutions. Pentamers can assemble to form variably sized particles. The C-terminal tails of VP1 allow nonequivalent bonding with adjacent pentamers. These variable tail interactions are unique to polyomavirus. The purpose of this study is to visualize and interpret these tail interactions by incubating VP1 proteins in neutral, low-ionic, and alkaline solutions and viewing with electron microscopy and cryogenic electron microscopy modeling. The VP1 samples were dialyzed against buffers to assemble the pentamers into small (T=1) and large (T=7) icosahedron and octahedral particles. We found that VP1 in a neutral, low ionic strength solution favored pentamer formation and T=1 assembly. The addition of calcium without the chelating agent led to variable assembly of pentamers, mainly T=1 but some octahedral in appearance. The polymorphisms in VP1 assembly in different solutions leads to variable tail interactions and switching of tail bonding in the formation of polyomavirus capsids.

**Poster 66**

**Presenter: Emma Nelson** (Southern Utah University)

Mentor: Cali Johnson (Surgery)

*Low Socioeconomic Status and Travel Time to Surgical Hospital in relation to Increased Rates of Complications and Re-amputations in Amputation Patients*

**Background:** Studies show that health disparities and socioeconomic status (SES) correlate to increased risk factors in amputation patients. Yet no research has determined how distance and travel time to the hospital affects amputation outcomes. The aim of this study was to determine if low SES and increased travel time to a surgical hospital correlate to increased rates of complications and re-amputations.

**Methods:** This was a retrospective cohort study of Vascular Surgery patients at the University of Utah Hospital from 2013-2021. Using the University's VQI database, data was pulled for all lower extremity bypass (LEB) procedures. Patients who subsequently underwent amputation were identified. Primary outcomes were amputation failure (any post-operative re-intervention, or a need for a more proximal amputation), ambulation, and mortality. Patients home addresses were used to determine travel time to the hospital, and SES according to the Area Deprivation Index (ADI).

**Results:** A total of 221 LEB patients were identified, 66 (29.9%) of which came from ADI I, the least disadvantaged group, 127 (57.5%) from ADI II, the moderately disadvantaged group, and 28 (12.7%) from ADI III, the most disadvantaged group. A total of 49 (22.2%) patients had an amputation on the same leg as their bypass procedure, with the majority coming from ADI II (55.1%). Of the 49 ipsilateral amputations, 17 (34.7%) healed, while 15 (30.6%) failed, or in other words required a more proximal amputation or a re-intervention. At long term follow up, over half (60%) of the patients who had a failed minor or major amputation were not ambulatory, which showed statistical significance ( $p < 0.001$ ).

**Conclusion:** SES of patients plays a role in amputation outcomes, and should be considered for each individual patient when creating a treatment plan to give them the best chance at success.

**Poster 67**

**Presenter: Bree Nevarez** (University of Utah)

Mentor: Craig Rush (Oncological Sciences)

*The underlying molecular characteristics of the progesterone receptor pathway.*

While case numbers and deaths from most cancers are decreasing, numbers for endometrial cancer are increasing. This has to do with the obesity increase in the USA, which is one of the factors that increases the likelihood that you can get Endometrial cancer. Also, therapy for this cancer has not evolved because, historically, Endometrial cancer has been treated by surgery. Currently, there are no targeted therapies. Despite this, we do know that P4--a hormone that effects progesterone receptors (PR)--is a therapeutic option.

Given progesterone receptor's putative role as a tumor suppressor our goal is to understand the underlying molecular characteristics of the progesterone receptor pathway.

The Ishikawa and HCl-ECl-23 endometrial cancer cell lines were used to do our experiments. With these cell lines, we did a qPCR to identify if gene expression of PR was present and if the induction of Doxycycline worked. Following that, a Western Blot was done to look for the presence of PR-A and PR-B proteins. To show that PR is functional, a luciferase experiment was conducted. Finally, a qPCR was conducted to find possible target genes.

The first qPCR showed PR-A and PR-B RNA production and that the Dox induction worked. The Western blot showed that PR proteins were being produced. Then we saw PR function through a Luciferase experiment. A second qPCR showed endogenous targets of the progesterone receptor, and the results of this experiment found a possible target gene. The Luciferase (ERE/PRE) experiment also showed that the induction for ER decreased compared to PR.



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We have found that PR is functional in the synthetic system that was used. PR-B is the active isoform and is P4 responsive. PR-A is active through endogenous genes. IGAF is a possible target gene. PR could potentially be dominate over ER (without looking at endogenous genes)

### Poster 68

**Presenter: Eric Norman** (Lewis & Clark College)

Mentor: Rajeshwary Ghosh (Human Genetics)

*Examining the role of p62 in Ischemic Heart Disease*

Ischemic Heart Disease (IHD) is a leading cause of heart failure. IHD induces tissue hypoxia, which can yield myocardial cell death. Under hypoxic conditions, Hypoxia Inducible Factor 1 Alpha (HIF1a), a transcription factor, is stabilized and promotes the expression of cardioprotective genes. Hence, HIF1a stabilization presents a potential pathway for developing IHD therapeutics. Previous studies show that Sequestosome 1 (p62), a ubiquitin-binding protein, stabilizes HIF1a in cancer cells by inhibiting prolyl hydroxylase isoform 3 (PHD3), an enzyme essential for HIF1a degradation. In cardiac cells, p62 accumulates under hypoxic conditions, and deletion of p62 reduces HIF1a stabilization. Therefore, we hypothesize that p62 stabilizes HIF1a in response to ischemic distress in cardiac cells to the extent that is functionally relevant. In order to test our hypothesis, H9c2 cardiomyoblasts will be transfected with control and p62 siRNA to knock down the p62 gene. Afterward, cells will be exposed to hypoxia and normoxia. Gel electrophoresis and immunoblotting will be used to determine HIF1a and p62 levels. We will use qPCR to quantify the expression of HIF1a target genes to characterize HIF1a activity. We anticipate heart cells with p62 knockout to decrease HIF1a levels and activity. We will then track the hydroxylation of HIF1a to further to access the p62 knockout effects on PHD3 activity. We anticipate PHD3 activity to increase in the absence of p62. Seeing as there are no viable HIF1a stabilizers for IHD treatment, p62 presents a novel approach to HIF1a stabilization that can lead to potential advancements in IHD therapeutics.

### Poster 69

**Presenter: Emmanuel Onyeagba** (University of Utah)

Mentor: William Holland (Nutrition and Integrative Physiology)

*The Role of FOXN3 in Glucagon Receptor Antagonist (REMD2.59)-mediated Cardioprotection.*

Diabetes is a metabolic disorder characterized by chronic hyperglycemia, hyperglucagonemia, and overall inability to regulate glucose as a result of a defect in insulin secretion. However, the importance of regulatory mechanisms that control the levels of sugar in our blood is not well understood. Diabetes is bi-hormonally regulated by insulin and glucagon. Previously, research and innovation of DM treatment have focused on the role of Insulin, in the control of serum glucose, but now we look towards the role of glucagon - the opposing hormone to insulin - to understand better ways to maintain glucose homeostasis. We use a drug known as isoproterenol to induce cardiac injury in mice and observe the derivatives of how a conserved gene FOXN3 is proteasomally degraded and how MYC ( a master glucose regulator gets turned on and promote hypertrophic growth, uptake of glucose and how it utilizes, down regulation of FAQ genes.

### Poster 70

**Presenter: Cody Page** (University of Utah)

Mentor: Kendall Gerdes (World Languages & Cultures)

*Forgiveness: A New Rhetorical Strategy for Creating an Equitable Criminal Justice System*

With the recent and seemingly increasing inequality throughout the United States, change is being demanded on every front; most forcefully those requests are aimed at the criminal justice system. Within the criminal justice system people of color are disproportionately affected by overly harsh administrative laws such as minimum mandatories, and racial prosecutorial rhetoric, leading to an increase in imprisonment and a decrease in equitable justice. The administrative laws responsible for the current climate within the criminal justice system were created in response to the Civil Rights movement in an effort to limit judicial discretionary power. At the time judicial discretionary power was often used to favor white people while simultaneously suppressing people of color. With the adoption of these administrative laws, equality, at first, seemed to increase, however after decades of use, it is apparent that these laws may actually be more arbitrary, more violent, and more suppressive than discretionary power. Carol Steiker, Rachel Barkow, Azia Huq, and Julia Shaw have advocated extensively for the abandonment of arbitrary overly strict laws in favor of laws that force the criminal justice system to examine each case and each person individually; they claim to varying degrees that this will eliminate racial bias and increase mercy in the criminal justice system. I use many of these principles to create a new rhetorical driving force within the criminal justice system, namely the rhetorical theory of forgiveness. The theory of forgiveness in effect allows for an increase in discretionary power while eliminating racial bias by holding judges and prosecutors accountable for laws and acts of inequality. Rather than basing the success of prosecutors and judges on the number of people punished, the theory of forgiveness institutes restoration and reintegration as the new standard of success. As the theory of forgiveness becomes the driving rhetoric of the criminal justice system, actors will feel a greater sense of responsibility to individuals and their circumstances.

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### Poster 71

**Presenter: Atiyana Paul** (North Carolina Agricultural and Technical State University)

Mentor: Lisa Gren (School of Biological Sciences)

*Out With Old, In With the New. Covid-19 Impact on HR staff at Utah Universities*

There has been literature reports produced that discuss how covid has impacted students and staff workers at universities but not many articles are out about how covid has had an impact on HR staff at universities. This research project I was able to participate in conducting qualitative interviews with different HR staff workers at different universities around Utah to hear about their experience and how their transition went throughout the pandemic. I received feedback regarding the different protocols put in place, what changes were successful or unsuccessful, how communication tactics and physical work environments changed, and how telework changed.

### Poster 72

**Presenter: Ava Peitz** (University of Utah)

Mentor: Ming Hammond (Chemistry)

*Frankenstein's Biosensors*

The Hammond group is on the forefront of RNA-based biosensor development. These biosensors operate through a fluorogenic dye-binding domain fused to an engineered riboswitch, requiring addition of dye to the system. Since this dye is added separately, it has the potential exhibit nonspecific or incorrect activation. To tackle this challenge, I aim to create a fully genetically encodable system from peptide and RNA-based components. This system would use an RNA-stabilized fluorogenic protein system rather than a dye-binding aptamer to show ligand presence through fluorescence, combining novel tools into a 'Frankenstein'd' sensor.

I will generate three versions of this system to sense three different immune signaling molecules: cyclic dinucleotide cGAMP and methyltransferases S-adenosyl-L-methionine and S-adenosyl homocysteine. Targeting interferon response through cGAMP sensing has high therapeutic potential for treating diseases such as cancer, neuroinflammatory conditions, and autoimmune disorders. Targeting methyltransferase activity allows for understanding of further upstream pathways from interferon response. After synthesizing the full proposed sensing systems in vitro, I tested their efficacy through binding assays.

In the future, I plan to express these working systems in vivo in mammalian cells- specifically, in neurons- and test their efficacy through microscopy. I hope to contribute to the furthering of techniques to study and treat mechanisms of both pathogenic and autoimmune inflammatory neurological conditions from the direction of immune signaling molecule sensing. It's exciting to imagine a tool, self-inclusive of all sensing components, that could be added to the growing network of therapeutics and diagnostics for diseases of a neuroinflammatory nature.

### Poster 73

**Presenter: Gary Perea** (University of Utah)

Mentor: Caroline Saouma (Chemistry)

*Kinetics of H<sub>2</sub> and CO<sub>2</sub> addition to a Ru hydrogenation catalyst that converts CO<sub>2</sub> to formate*

The hydrogenation of CO<sub>2</sub> to formate is generally thought to proceed via CO<sub>2</sub> insertion into a metal hydride. Indeed, (PNP)Ru(H)<sub>2</sub>(CO) readily inserts CO<sub>2</sub> to give the corresponding (PNP)Ru(H)(CO)(OCHO) species (PNP = 2,6-bis(di-tert-butylphosphinomethyl)pyridine). However, we have observed that the formate species can also be formed from addition of H<sub>2</sub> to the ligand-bound CO<sub>2</sub> species, (CO<sub>2</sub>-PNP)Ru(H)(CO). Given that ligand-bound CO<sub>2</sub> species are generally regarded as detrimental to catalysis, we sought to determine the mechanism of formate production. My poster will describe kinetic studies on H<sub>2</sub> and CO<sub>2</sub> addition to pertinent Ru species, such that the mechanism can be deduced. This work is pertinent to establishing mechanisms for H<sub>2</sub> addition to carbonyl substrates.

### Poster 74

**Presenter: Catherine Petersen** (University of Utah)

Mentor: Ramkiran Gouripeddi (Biomedical Informatics)

*Examining the Temporal Relationship between Air Quality Trends and Glycemic Outcomes among Patients with Type II Diabetes Mellitus*

Type 2 diabetes mellitus (T2DM) is a chronic condition caused by insulin resistance and metabolic dysfunction. Approximately 37 million individuals in the United States have T2DM. Long term exposure to air pollution is thought to increase insulin resistance and impair glucose metabolism due to oxidative stress and inflammation. Particulate matter with an aerodynamic diameter  $\leq 2.5 \mu\text{m}$  (PM<sub>2.5</sub>), more specifically its ultrafine component, can cross the pulmonary alveolar membrane and direct inflammatory effects on target organs. While several studies have identified a relationship between PM<sub>2.5</sub> concentrations and onset of T2DM, few studies have examined the role of air pollution on glycemic outcomes after T2DM diagnosis. There is a possibility of air pollution worsening glycemic control and metabolic dysfunction, and contribute to poor glycemic outcomes. Therefore, the objective of this research was to evaluate the relationship between temporal trends in PM<sub>2.5</sub> concentrations and glycemic outcomes among patients with T2DM in Davis, Utah, and Salt Lake Counties in Utah. Electronic medical record data from EPIC for 143,434 patients with an eligible ICD-10 diagnosis code for T2DM from 2010-2022

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were selected for analysis. PM2.5 concentrations were extracted from the EPA's Air Quality System in Davis, Utah, and Salt Lake counties in Utah. The date of a patient's initial diagnosis was found and visually assessed with one-year trends in PM2.5 concentrations. Analysis is ongoing and it is hopeful that the results of this study will elucidate the role of PM2.5 concentrations on glycemic outcomes in patients with T2DM and may inform public health interventions to minimize air pollution and encourage better outcomes for individuals with T2DM.

### Poster 75

**Presenter: Nizhoni Porter** (University of Utah)

Mentor: Anandh Velayutham (Nutrition and Integrative Physiology)

*Effects of Blueberries Supplementation on Oral Dysbiosis*

The gut and oral cavity are the two largest microbial habitats within the human body and are closely connected through the digestive pathway. The oral microbiome plays a key role in maintaining homeostasis within the oral cavity and promoting overall health. An imbalance in the oral microbes (an increase in opportunistic bacteria with a decrease in beneficial commensal bacteria) leads to a condition called oral dysbiosis. This condition is implicated in oral diseases (periodontitis, caries, and oral cancer) and systemic diseases (diabetes, inflammatory bowel disease, cardiovascular disease, and Alzheimer's disease). A high-fat diet (HFD) with antibiotics cooperatively triggers dysbiosis that exacerbates several host complications. This study will evaluate whether supplementation of blueberry improves HFD and antibiotic-induced oral dysbiosis in C57BL/6J mice. The mice will be in 5 groups of 10, the control (C) high-fat diet (HF), high-fat with antibiotic water (HFA), high-fat with freeze-dried blueberries and antibiotic water (HBA), and high-fat with freeze-dried strawberries and antibiotic water (HSA). Phytochemicals such as anthocyanins found in blueberries act as a prebiotic which means they act as a stimulant to promote the growth of beneficial gut bacteria. Due to the probiotic effect of anthocyanins and the translocation of bacteria between the oral and gut microbiota, this correlation could help replenish the gut and oral microbiome once destroyed or altered and therefore aid in creating a healthier immune system.

### Poster 76

**Presenter: Audrey Pozernick** (University of Utah)

Mentor: Tiffany Baffour (Sociology)

*A Scoping Review of Anti-Racism in Higher Education: Implications for Transforming Organizational Culture*

Higher education in the United States continues to foster whiteness within its spaces, curricula, and policies. Though students and faculty members that are Black, Indigenous, or People of Color (BIPOC) do their best to make themselves and their experiences visible to the white dominated institutions they are within, their needs are misunderstood due to white ignorance or deliberately ignored. Most colleges and universities do admit that racism is a problem within their institutions. However, they will not act to initiate anti-racist policies that will ensure racially conscious inclusive curricula, faculty development protocols (hiring, retention, promotion and tenure, funding, pay equity, pedagogical strategies), and equity-minded student development strategies (recruitment, retention, scholarships/funding). Since the murder of George Floyd and Derrick Chauvin's conviction on national TV, many BIPOC students are witnessing, leading, and participating in the rise of conversations around racial inequity and injustice within their education institutions. This paper will examine the role of social justice movements and how they influence current anti-racist policies and practices within higher education.

### Poster 77

**Presenter: Divya Proper** (College of Charleston)

Mentor: Joe Yost (Neurobiology & Anatomy)

*Investigation of gene knockdown efficiencies of CRISPR/Cas13d and Cas7-11 in zebrafish*

Gene knockdown is a powerful approach to investigate gene function. CRISPR-based technologies have made targeted gene knockdown in several model systems more facile and accessible.

Cas13d, a class 2 type VI CRISPR-Cas RNA endonuclease, has recently been shown to effectively induce mRNA knockdown in the zebrafish model. However, in addition to its on-target activity, Cas13d also has 'collateral' activity that results in significant off-target effects. Thus, there is a need to develop targeted gene knockdown approaches with minimal off-target activity. mRNA knockdown by Cas7-11, a type III CRISPR-Cas RNA endonuclease, was recently shown to be successful in target knockdown in mammalian cells without non-specific activity and negative effects on cell viability. However, the efficacy of this technique has not been assessed in zebrafish. In order to compare the effectiveness of RfxCas13d and DiCas7-11 for RNA knockdown in zebrafish, DiCas7-11 was cloned into pT3TS. Next, in-vitro transcription of both RfxCas13d and DiCas7-11 was conducted. Guide RNAs (gRNAs) targeting several genes with known phenotypes in zebrafish embryos were also generated as controls to assess knockdown efficiency. After injecting zebrafish embryos at the one-cell stage with the mRNA encoding for either RfxCas13d or DiCas7-11 and the gRNAs, embryos were screened for expected phenotypes several hours post injection. I discovered that RfxCas13d mediated gene knockdown results in significant deformities in the injected embryos, likely due to Cas13d's known 'collateral' activity. This study aims to provide a direct comparison of two CRISPR knockdown technologies in order to improve off-target effects of the existing validated technology.

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### Poster 78

**Presenter: Tony Qiang** (Carleton College)

Mentor: Greg Ducker (Biochemistry)

*Metabolite reprogramming affected by  $\beta$ -catenin-activated in THLE cells*

Hepatocellular carcinoma (HCC) is one of the most lethal cancers and yet remains largely inaccessible to both immuno and targeted therapies. In one-third of human HCCs, tumors contain mutations that activate the WNT/  $\beta$ -catenin pathway, a developmental pathway that controls a large set of metabolic and signaling pathways. Many metabolic pathways contribute to tumorigenesis, but in liver cancer lipid metabolism has been described as potentially playing an outsized role. While it is known that key master transcriptional regulators of lipid metabolism are targets of  $\beta$ -catenin, the precise alterations in lipid fluxes that are induced by mutant  $\beta$ -catenin signaling are unknown. To reveal the metabolite reprogramming affected, we studied the non-transformed liver cell line THLE with and without an inducible transgene encoding mutant  $\beta$ -catenin. We studied phospholipid metabolism by tracking metabolite labeling from stable isotope tracers. In our experiments, we treated activated  $\beta$ -catenin THLE cell lines with isotope-labeled choline, ethanolamine, and serine and harvested the cells after 24 hours to determine lipid production fluxes. After the extraction of lipids from the harvested cells, the LCMS results of the lipid metabolites were compared with the results of the controlled group. We found that  $\beta$ -catenin-activation significantly decrease Phosphatidylcholine (PC) fluxes, suggesting that key enzymes controlling this metabolism are affected by  $\beta$ -catenin. Our study will help us better understand the landscape of changes in lipid metabolism in HCC and support the future validation of lipid metabolism as a therapeutic target in this tumor type.

### Poster 79

**Presenter: Daniela Ramos** (Texas Tech University)

Mentor: Scott Summers (Nutrition and Integrative Physiology)

*Overexpression of Ceramide Synthase 6 and its Effects on Cardiac Function*

Type 2 Diabetes (T2D) and heart failure (HF) are highly comorbid diseases leading with poor mortality rates. T2D is characterized by the body's inability to recognize insulin through an alteration of the insulin signaling pathway. Toxic sphingolipids like ceramides accumulate in obesity, linking over-nutrition to insulin resistance and other metabolic diseases like HF. Previously, our lab has shown that whole-body deletion of *Degs1*, the gene which encodes for the enzyme responsible for synthesizing ceramides from dihydroceramides, is sufficient to rescue glucose and insulin intolerance. However, it remains unclear whether circulating or cardiomyocyte-derived ceramides are sufficient to induce HF. Here, we show that ablation of *Degs1* rescues cardiac output and cardiac dysfunction in leptin deficient mice. Building on these data, we hypothesize that cardiomyocyte-specific overexpression of *CERS6*, a ceramide synthesis enzyme just upstream of *Degs1* that creates highly toxic C16:0 ceramides, is sufficient to induce HF in mice.

Through CRISPR-Cas9 technology, we inserted human *CERS6* gene with loxP sites flanking the stop codon in mice. Mice expressing an inducible cardiomyocyte Cre (*CERS6iCOE*) and littermate controls (*CERS6fl-STOP-fl*) are treated tamoxifen at 8 weeks of age and allowed to age until 15 weeks of age. Animals overexpressing *CERS6* developed HF depicted by reduced ejection fraction and fractional shortening as measured by echocardiography. RT-qPCR analysis revealed that animals overexpressing *CERS6* had increased transcripts of pro-fibrotic genes and markers of HF, including natriuretic peptides. Findings from this study will lead to a better understanding of the relationship between HF, ceramides, and diabetes.

### Poster 80

**Presenter: CJ Reid** (University of Utah)

Mentor: David Grainger (Pharmaceutics & Pharmaceutical Chemistry)

*Correlating Culture Conditions and Cell Sheet Characteristics*

Cell sheets have long been studied as a method of producing tissue-like constructs for tissue regeneration in a variety of diseases. A current area-of-focus is augmenting the in vivo efficacy of these sheets while minimizing fabrication cost. One route for efficiency is the creation of larger sheet areas, allowing higher cell densities to be applied to the implant site while minimizing cultureware use. This larger area and lower cost is pursued by using commercial temperature-responsive (TR) cell culture dishes rather than smaller and more expensive semipermeable TR inserts. However, lack of basal media absorption may negatively affect sheet characteristics for regenerative capacity. Other factors to consider are glycosaminoglycan (GAG) production as a predictor of chondrogenic differentiation potential of the cultured cells.

Despite current cell sheet research progress, the exact methods of maximizing these culture conditions for sheet quality are still unclear, as are the potential effects of standard media volume and dish types. Identifying critical culture factors that affect cell sheet growth is crucial in improving the future clinical translational viability of this technology. Reducing sheet costs by using new TR dishes instead of expensive current TR inserts only works if they provide sheets of similar or better quality.

This research examines the histology of human juvenile chondrocyte sheets grown in both TR dish and semipermeable TR insert cultureware to identify the differences in sheet properties. Also analyzed is sheet differentiation potential into cartilage-like tissue-specifically for use in repairing articular chondral defects-as represented by GAG production and pellet size after chondrogenesis. While

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the primary research goal seeks to examine the culture dish performance compared to a TR insert, these experiments also flag differences in cell culture media volumes and cultureware plastics as substrates of cell growth by analyzing cell sheets cultured under six different conditions.

### Poster 81

**Presenter: Francisco Reyes** (Amherst College)

Mentor: Kevin Perry (Atmospheric Sciences)

*Analyzing Dust Particle Size Ratios Versus Soil Moisture and Wind Shear In Farmington Bay*

The composition of a dust plume is a critical factor in modelling its spread. In particular, the ratio of particles smaller than 2.5 micrometers (PM<sub>2.5</sub>) and particles smaller than 10 micrometers (PM<sub>10</sub>) are vital for this modelling. However, the ratio of PM<sub>2.5</sub> to PM<sub>10</sub> is a poorly documented and largely unknown factor in the Great Salt Lake valley. Here, we explore this ratio and its relationship with wind shear velocities and soil moisture in 11 sites inside the Farmington Bay area of the Great Salt Lake playa using a Portable In-Situ Wind Erosion Lab (PI-SWErL). Our data show a strong positive correlation between a higher wind shear velocity and a higher PM<sub>2.5</sub> to PM<sub>10</sub> ratio for most PM<sub>10</sub> concentrations above 1 mg/m<sup>3</sup>. They also suggest a weak correlation between higher PM<sub>2.5</sub> to PM<sub>10</sub> ratios and higher soil moisture. This research provides a preliminary body of data for further investigation into these relationships as well as more accurate estimates of the PM<sub>2.5</sub> to PM<sub>10</sub> ratio.

### Poster 82

**Presenter: Daven Rock** (Carleton College)

Mentor: Nels Elde (School of Biological Sciences)

*The Cytotoxicity of Viral Restriction Factor retroCHMP3 and Compensatory Evolution of the ESCRT pathway in Saccharomyces cerevisiae*

The ESCRT (endosomal sorting complex required for transport) pathway is a key cellular mediator of cargo delivery to the lysosome and cell abscission but is also used by retroviruses, such as HIV, for viral budding and release. RetroCHMP3 (charged multivesicular body protein 3) is a newly discovered viral restriction factor that blocks viral budding via the ESCRT pathway. However, due to the key role of the ESCRT pathway in membrane trafficking, blockage of the pathway by retroCHMP3 has also been found to be slightly cytotoxic. The current study examines the extent of retroCHMP3 cytotoxicity in *Saccharomyces cerevisiae* (yeast) and potential compensatory evolution of the CHMP genes that improves cell viability. The cytotoxicity of retroCHMP3 and related CHMP proteins (CHMP3, truncated CHMP3, and codon-optimized retroCHMP3) was assessed in yeast by spot assay. Furthermore, an experimental evolution analysis was conducted whereby growth rate, compensatory mutations, and gene duplications were assessed over time in yeast expressing a highly cytotoxic, dominant negative form of retroCHMP3 (truncated CHMP3). This project advances the current understanding of the ESCRT system by seeking to identify mechanisms through which the highly conserved ESCRT pathway can selectively restrict viruses while maintaining cell viability.

### Poster 83

**Presenter: Dariana Rodriguez Purcell** (University of Tampa)

Mentor: Ellen Leffler (Human Genetics)

*Comparing Evolutionary Properties of Essential and Non-Essential Genes in Plasmodium falciparum*

*Plasmodium falciparum* is known as the most lethal malaria-causing parasite. Traditionally, malaria has been a difficult disease to treat due to the highly adaptable nature of the parasite, resulting in the evolution of resistance to anti-malarial drugs. Essential genes are crucial for survival and are thus potential drug targets. Additionally, genes that are essential for survival are expected to be under stronger purifying selection than non-essential genes, which is hypothesized to lead to slower evolutionary rates and increased retention across species. However, studies testing this hypothesis have delivered mixed results, possibly indicating differences across taxa or definitions of gene essentiality. In general, a stronger relationship has been found between evolutionary rate and gene expression level than essentiality. Here, we aim to characterize the evolutionary properties that differ between essential and non-essential genes in *Plasmodium falciparum* using recent large genomic and transcriptomic datasets. Working with a list of essential genes our lab has curated in *Plasmodium falciparum* based on loss-of-function intolerance, we will test whether essential genes have slower evolutionary rates than non-essential genes. We will also evaluate whether these genes have been lost less often across the *Plasmodium* phylogeny and whether they show broader expression patterns. This work will provide insight into how essentiality relates to evolutionary patterns in *Plasmodium* and could help inform selection of more evolutionarily-constrained drug targets.

### Poster 84

**Presenter: Alanis K. Rodriguez-Diaz** (University of Puerto Rico at Mayaguez)

Mentor: Carsten Rott (Physics & Astronomy)

*IceCube-Gen2 Environmental Impact: Utilization of solar panels at the IceCube detector site*

The discovery of high-energy astrophysical neutrinos with IceCube has opened this new window to the Universe. IceCube has been successful in finding first evidence for cosmic particle acceleration in the jet of an active galactic nucleus. Yet, IceCube's sensitivity would



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only allow for the detection of a very limited sample of bright neutrino sources, or to detect populations of less luminous sources. Therefore, a next-generation instrument, IceCube-Gen2 is needed to sharpen our understanding of the Universe at the highest energies. IceCube is currently the largest neutrino telescope that successfully uses the Antarctic ice as a detector medium. The South Pole environment holds challenges for neutrino detector operations, in particular through the availability of electrical power. Renewables might be able to help augment power production for future neutrino detectors at the South Pole. In this project we investigated the use of solar power at pole to reduce the environmental footprint of IceCube-Gen2. We have created a test setup at the University of Utah consisting of a 24-volt battery, a maximum power point tracker (MPPT) charge controller and a bifacial solar panel. The setup was used to test the power generation efficiencies for the detector site at the South Pole. The test was conducted at the Bonneville Salt Flats in Utah to simulate the South Pole's conditions, such as a highly reflective environment. The collected data from this test is integrated into two python programs that predict the power output of the bifacial solar panel based on the temperature, Julian date, azimuth and zenith angles between the panel and Sun.

### Poster 85

**Presenter: Hannah Rosenberg** (University of Pittsburgh)

Mentor: Ming Hammond (Chemistry)

*Discovering new riboswitches selective for cGAMP*

The study of intracellular signaling molecules is integral to understanding the cellular pathways and functioning of bacterial organisms. One such signaling molecule, cyclic GMP-AMP (cGAMP), is a type of cyclic dinucleotide, which is a class of secondary messengers that has been expanded within the last decade. Previous research focusing on cGAMP has highlighted its role in bacterial electrophysiology and immune defense against phage infection. However, there is still much unknown about which bacterial species utilize this signaling molecule and other roles it may play in gene regulation. Here, we have identified novel cGAMP riboswitches from a variety of bacterial species using RNA-based fluorescence biosensors to screen for selectivity between cGAMP and cyclic di-GMP, another important cyclic dinucleotide signal in bacteria. We are analyzing the affinities of varying riboswitches to cGAMP at different temperatures, magnesium concentrations, and pH ranges, and are finding new examples of cGAMP-selective as well as promiscuous riboswitches. Discovering cGAMP riboswitches in new bacterial lineages will help to expand our understanding of the role of cGAMP signaling in bacterial physiology.

### Poster 86

**Presenter: Ana Rowe** (University of Utah)

Mentor: John Parkinson (School of Biological Sciences)

*Suppression of Chemoreceptor Signal-Switching Defects*

The model bacterium *Escherichia coli* contains a chemotaxis system that allows the cell to change its swimming behavior in response to the environment. As the cell swims, transmembrane chemoreceptors detect concentration changes in attractant and repellent compounds and transmit signals across the inner membrane that elicit an appropriate locomotor response. The Parkinson lab studies the serine chemoreceptors Tsr in *E. coli* to investigate the mechanism of transmembrane signaling. Previous work identified an amino acid near the cytoplasmic tip of the receptor (F396) that plays a critical role in enabling Tsr to modulate its signal output in response to a serine stimulus. The objective of my project is to characterize second-site mutations that rescue the chemotactic ability of F396 receptor mutants. These suppressors presumably enable mutant receptors to undergo the conformational changes necessary for serine sensing and signaling. To identify such suppressors, I subjected plasmids that encode Tsr-F396G (glycine) or Tsr-F396W (tryptophan) mutant receptors to random mutagenesis and selected for mutant plasmids that promoted improved serine chemotaxis. DNA sequence analysis of the revertant plasmids showed that most of the suppressor mutations lie near the hairpin tip of Tsr. I obtained few F396W revertants and none with substantially improved function as compared to F396G, which gave rise to more revertants that are better able to restore chemotactic function. In my proceeding experiments I will determine the expression levels of the doubly mutant Tsr proteins and characterize their signaling properties with in vitro FRET-based kinase assays. By analyzing these properties of the suppressor mutations found, it will be possible to identify Tsr structural features important for signal control of the cytoplasmic tip and create a more complete model of transmembrane signaling.

### Poster 87

**Presenter: Carrie Schultz** (University of Utah)

Mentor: Tim Webster (Anthropology)

*Using the Pairwise Sequential Markovian Coalescent (PSMC) to examine the effects of Pleistocene climate fluctuations on primate populations*

Using the Pairwise Sequential Markovian Coalescent (PSMC) to examine the effects of Pleistocene climate fluctuations on primate populations

The Pleistocene epoch is characterized by climate cycles that caused fluctuations in temperature, sea level, and forest cover among other things. Environmental changes such as these can influence mammal population sizes and health. Several studies have been conducted that look at the relationship between climate fluctuations and effective population size, currently and in the past. The Pairwise Sequential Markovian Coalescent (PSMC) is a method that has been used in such studies. PSMC is a computational method that uses the whole

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genome of a diploid individual. It can be used to infer effective population size, which is an important concept in both population genetics and conservation genetics. Effective population size gives insight into how evolutionary forces impact population health. This project worked to understand how PSMC works, and how it can be applied to conservation research. In order to understand the process of using this method, a chimpanzee genome was used. Before PSMC could be applied to the genome, several steps had to be taken. This included preparing the genomic data to be used, creating the necessary files and file formats, and exploring the various parameters used in PSMC. Because PSMC is a computational method, everything was done using computer programs and programming languages such as python and Snakemake. After applying this method to the chimpanzee genome and adjusting the parameters to meet the specific requirements of the species, the result shows how the effective population size of the chimpanzee individual changed over the course of the Pleistocene, a time period that lasted over two million years. This result can then be used to understand the relationship between the population and the climate at that time.

### Poster 88

**Presenter: Ben Searle** (University of Utah)

Mentor: Lauren Barth-Cohen (Educational Psychology)

*Investigating Interactions Between Students and TAs/LAs in a Reform-Based Introductory Physics Laboratory*

Engaging in the scientific process through laboratory experiments is a significant component of learning physics. The Introductory Physics for Life Science (IPLS) laboratories at the University of Utah are facilitated by a team of teaching assistants (TAs) and learning assistants (LAs), who are responsible for providing resources and support for the students to perform the experiments that they design. The frequency of interactions between students and TAs/LAs has important effects on the engagement of students in the lab and performance on lab tests (Stang and Roll, 2014). We use a qualitative research study to explore how TAs/LAs interact with students to support laboratory engagement, and the varied amount of interactions that TAs/LAs have with students. Several sections of the laboratory were recorded and moments where students interacted with TAs/LAs were analyzed to describe how student-TA/LA interactions facilitate engagement with science.

### Poster 89

**Presenter: Colton Seegmiller** (Utah Valley University)

Mentor: Taylor Sparks (Materials Science and Engineering)

*DiSCoVeR-ing Chemically Novel, High-Temperature Superconductors*

Superconductivity has been a major focus in research since its discovery in 1911. There is still much to learn about superconductors, with one of the biggest unsolved problems in condensed matter physics being what mechanism causes high-temperature superconductivity and if there exists a material that can superconduct at both room temperature and atmospheric pressure. The most important property of a superconductor is its critical temperature ( $T_c$ ) or transition temperature, which is the point at which a material transitions into a superconductive state. This research implements the DiSCoVeR algorithm to first train on the SuperCon dataset consisting of known superconductors and their critical temperatures, and then predicts on the NOMAD dataset which consists of around 700,000 novel chemical formulas. Having a combination of a chemical distance metric, density-aware dimensionality reduction, clustering, and a regression model, the DiSCoVeR algorithm serves as a tool to identify and assess superconductive compositions [Baird]. This research and implementation resulted in the screening of chemically novel compositions exhibiting critical temperatures upwards of 130 K, which relates to superconductors in the cuprate class.

### Poster 90

**Presenter: Carlos José Sepúlveda Irizarry** (University of Puerto Rico - Rio Piedras Campus)

Mentor: Ian Boys (Human Genetics)

*Using structural predictions to study host genes captured by viruses*

Poxviruses, a family of DNA viruses that include important human pathogens such as monkeypox, are known to "capture" genes from their hosts via horizontal gene transfer. Over evolutionary time, some captured host genes are modified to benefit the virus by altering host processes and interfering with immune responses, often by acting as molecular mimics of host proteins. The study of viral mimics of host proteins provides insight into virology and host biology, but sequence divergence can obscure relationships between virus and host proteins, limiting their study. We use AlphaFold, a breakthrough algorithm capable of accurately predicting protein structures, to model the proteome of vaccinia virus, a model poxvirus. Through structural homology searches we identified several possible mimics of host proteins, including vaccinia protein B6, which has structural similarity to proteins in the BCL2 family proteins. BCL2 family proteins are known to regulate apoptosis, and B6 shares most structural similarity with anti-apoptotic members. We hypothesize that B6 has a role in preventing cell death. For this study, B6 will be expressed alongside various BCL2 family proteins in cell culture and perform apoptosis assays to determine if and how they interact. Additionally, we have used immunofluorescence microscopy to assess the subcellular localization of B6, and preliminary results suggest that B6 is localized to the endoplasmic reticulum. Within the context of our homology screen, understanding the role of B6 will provide valuable information on the relationships between protein structure and protein function, illuminating new ways that viruses use mimicry to promote their survival.

## Session I 9:00AM – 10:30PM

### Poster 91

**Presenter: Mary Frances Shannon** (Hendrix College)

Mentor: Amy McDonnell (Psychology)

*The Cognitive Effect of Nature Imagery on Reward Positivity*

Attention Restoration Theory (ART; Kaplan, 1995) suggests that exposure to natural environments replenishes attentional resources that are depleted by our over-stimulating, urban environments. Previous literature has found that immersion in nature does, in fact, improve various cognitive control processes, which we study to test Kaplan's theory about directed attention (Kaplan, 1995; LoTempio et al., 2020). Reward processing is one type of cognitive control process by which people allocate their attention based on reward- and loss-related feedback. Reward positivity can be measured through the event-related brain potential RewP that peaks in response to reward feedback. McDonnell et al. (in prep) found a decrease in the RewP amplitude during nature immersion compared to immersion in an urban environment. The present study measures the amplitude of the RewP to assess whether pictures of nature can influence reward processing in the brain like immersion in nature does. We use electroencephalography (EEG) to record participants' brainwaves three times while completing a gambling task that is commonly used to elicit the RewP brainwave. Participants viewed images at the second session. We compare the RewP between viewing nature and urban images and between nature and no images. We expect to observe a decrease in the amplitude of the RewP brainwave in the nature condition, suggesting that participants would be less sensitive to monetary rewards with exposure to nature imagery in comparison to urban imagery and no imagery. Nature imagery would put participants in a state that would not demand as much attentional control.

### Poster 92

**Presenter: Elena Sjoblom** (University of Utah)

Mentor: Ilya Zharov (Chemistry)

*Investigating Organosilica Nanoparticle Recrystallization*

Organosilica nanoparticles have been researched extensively over the past decades for their uses in silica-based transports, supports, and, most recently, drug delivery. However, many aspects of the mechanism of formation of organosilica nanoparticles are still unknown. Since these nanoparticles are capable of forming several useful morphologies, with potential qualities such as mesoporous, hollow, or crystalline, it is necessary to understand the mechanisms behind the formation of these morphologies. This study specifically investigated the mechanism behind organosilica nanoparticles that recrystallize during their synthesis. Syntheses of crystalline nanoparticles starting from different organosilane precursors were done with varying pH conditions, surfactants, co-solvents, and hydrolyzing agents. These syntheses were monitored over time with TEM and XRD to characterize the resulting nanoparticles. Using physical appearance observed with TEM and crystallinity quantified by XRD, this study revealed that crystalline particles first evolve from a loose core framework that dissolves, creating hollow nanoparticles with low crystallinity, which subsequently evolve into a highly crystalline morphology over time. Previous work in silica nanoparticle chemistry has most often cited emulsion templating as the mechanism of formation of hollow silica nanoparticles. However, we have found this to not match the evolution of hollow nanoparticles in general, including hollow particles that evolve to form crystalline nanoparticles. Instead, the formation of hollow to crystalline organosilica nanoparticles relies more on colloidal stability and dissolution to form the unique morphologies of hollow to recrystallized silica nanoparticles.

### Poster 93

**Presenter: Darrien Smiley** (Fort Lewis College)

Mentor: Scott Summers (Nutrition and Integrative Physiology)

*Characterizing the Behavior of FOXN3 in Models of Heart Failure*

The concentration of glucose is tightly regulated by insulin and glucagon—that respond to glucose concentrations and nutritional state. Disruption in this homeostasis, metabolic dysfunction occurs leading to Diabetes Mellitus (DM). DM is a leading cause for heart dysfunction, where patients are two to four times more likely to develop heart failure. Hyperglucagonemia and systemic hyperglycemia are key features of DM. Recently glucagon has been implicated to be cardiotoxic and a potential contributor to cardiac dysfunction. Current interventions effectively lower glycemia however it may not be advantageous to the heart. Work in the Summers-Holland lab on glucagon blockade have shown that administration of glucagon receptor antagonist antibody (REMD 2.59) significantly reduces blood glucose, and improves cardiac function in diabetic mice. Further exploration into REMD 2.59 specific cell autonomous effects and mechanism in the heart remains to be explored. We hypothesize that Forkhead Box Family N, Member 3 (FOXN3) plays a role in REMD 2.59 mediated cardioprotection. FOXN3 is a transcription regulatory gene that represses MYC- a master regulator of glucose metabolism and recently identified as a key gene in genetic cardiac hypertrophic hearts. Preliminary studies in the Summers-Holland Lab in collaboration with the Schlegel Lab have demonstrated: 1.) FOXN3 is glucagon responsive, 2.) FOXN3 is stabilized in the presence of REMD 2.59 and, 3.) global loss of FOXN3 results in cardiac dysfunction and increased death. Using FOXN3 overexpression, knockout, inducible heart failure mouse models in conjunction with antagonist challenges and cardiac echography, we will explore how FOXN3 expression prevents cardiac hypertrophy and fibrosis in REMD 2.59 treated mice.

### Poster 94

**Presenter: Ricky Soto** (Northwest Nazarene University)

## Session I 9:00AM – 10:30PM

Mentor: Aylin Rodan (Human Genetics)

*Understanding loco mutations in the Drosophila Melanogaster in correlation to Salt Stress*

It has previously been shown that flies carrying a loco mutation in their third chromosome are resistant to high salt stress. Previous data from Rodan lab shows loco mutants in every feeding, at increasing salt concentration, continue to live longer than the control group. The loco mutation is a regulator of the G protein coupling pathway, and it is noticed that the reduced expression of the loco protein creates a more significant stress resistance. The opposite occurs when the loco protein is overexpressed as the resistance decreases. With this in mind, it is known that the mammalian homolog of the loco gene is RGS14, and thus it is believed that loco/RGS14 is involved in salt sensitivity in flies and mammals. However, the mechanisms underlying the protective effects of the loco mutation are unknown and are under study in the lab. The GAL4-UAS Binary Expression System is used for this experiment to manipulate the expression in target cells and tissues. A salt stress assay is then performed using flies carrying both the driver and reporter lines to see if salt resistance is exclusive to the experimental fly. A cross between 2 different strains was made to obtain a rescue fly, allowing us to have a fly with tissue-specific overexpression and cross to tissue-specific GAL4 genes. Using C42-GAL4, active in rectal pads and principal cells of the malpighian tubules of the fly, we can observe if these organs mainly contributed to the tolerance against high salt stress in loco mutant flies. In humans, older age increases the risk for salt sensitivity, high blood pressure, and chronic kidney disease. Thus, we are interested in understanding these interactions of salt sensitivity in loco mutant flies.

### Poster 95

**Presenter: Elizabeth Stump** (Missouri University of Science and Technology)

Mentor: Jeff Bates (Materials Science and Engineering)

*Biodegradable Films for Food Packaging*

Single use plastics make up almost half of all plastic waste. This research works to create biodegradable polymers which can be formed into films to be used in food packaging such as plastic wrap and sandwich bags.

### Poster 96

**Presenter: Sean Sullivan** (University of Minnesota - Twin Cities)

Mentor: Michael Simson (Materials Science and Engineering)

*Stable High-Temperature Molten Salt Reference Electrodes*

High temperature reference electrodes are necessary to monitor the redox potentials in molten salt systems, a medium which serves as a potential coolant for nuclear reactors, pyroprocessing, and recycling spent nuclear fuel. This project is part of a larger project in determining the design of such a reference electrode which would last up to 6 months. Doing so allows the progression of molten salt in these uses to decrease the high corrosivity of molten salt. This project tested the stability of three candidate structural materials for these reference electrodes (Ni, Ni<sub>201</sub>, and W) to determine their electrochemical and structural stability over a 30 day period at 650 Celsius. This experiment was ended prematurely due to design issues of the experiment associated with several confounding variables that make analysis of electrochemical measurements difficult, such as variable electrode immersion depth. In the end, several design weaknesses were determined and will be redesigned in the next iteration of this 30 day test to reevaluate candidate structural materials for high temperature reference electrodes.

### Poster 97

**Presenter: Maegan Thomas** (University of Utah)

Mentor: Rebecca Simmons (Obstetrics & Gynecology)

*Comparing Contraceptive Use Prior to and After Abortion In Utah- The Role of Rurality In Contraceptive Decision Making*

**Objective:** Contraceptive options may be limited for people in rural Utah in comparison their urban counterparts. Our objective was to assess contraceptive method use and selection before and after abortion services among rural and urban individuals.

**Methods:** We utilized data from a study assessing contraceptive use prior to and after abortion. This study collected pre-and post-abortion data from participants, including contraceptive methods used prior to pregnancy, and contraceptive methods used at 3-months after their abortion. We conducted multivariable linear and logistic regression models to assess contraceptive use patterns and compare differences in contraceptive use. All analyses were conducted using Stata.

**Results:** A total of 527 people were enrolled in the parent study, 49 (9.3%) of whom were from rural areas. Our analyses found that rural people reported using fewer contraceptive methods prior to their abortion than urban individuals (ARR: -0.053; 95% CI: -0.531- 0.423). The majority of our findings did not reach statistical significance, likely due to the small sample of rural participants. However, our study did identify several points of borderline significance for further investigation. We found that people who reported difficulty in accessing contraceptives were more likely to report using a method they'd previously used before at their 3-month post abortion follow-up (ARR: 0.178; 95% CI: -0.145, 0.502). Among participants, rural people were more likely to report use of the same method pre- and post-abortion (AOR: 1.73; 95% CI: 0.359, 8.337). We also found that rural participants were more likely to report acquiring their birth control online (AOR: 2.7; 95% CI: 0.83, 8.75).

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**Conclusion:** Rural and urban participants showed some differences in both the number of methods they'd used prior to their abortion, as well as their ability to access methods pre/post-abortion. These findings support the need for more research on contraceptive access barriers among individuals living in rural Utah.

### Poster 98

**Presenter: Jade Underwood** (Fort Lewis College)

Mentor: Martin Tristani-Firouzi (Pediatrics)

*Isolation of Single Cell Cardiomyocytes from Adult Zebrafish Atria*

Zebrafish are an emerging model to study heart development and cardiovascular disease due to its functional similarities to human hearts. Zebrafish presents additional advantages as an animal model in cardiac research, including fast reproduction, transparent embryos, and a capability for genetic manipulation. The most commonly used protocols for cardiomyocyte isolation from adults zebrafish heart are using ventricle or whole heart. Our objective was to design a protocol to isolate cardiomyocyte from the zebrafish atria that could be then use to study cell functionality. and ventricle using the Pierce Primary Cardiomyocyte isolation kit. We explanted hearts from adult zebrafish and separated the ventricles and atria, Atria were incubated in the cardiomyocyte isolation solution from the Pierce Primary Cardiomyocyte isolation kit at 32°C. To find the optimal digestion time, we varied the incubation time in different samples from 30 to 45 minutes, in 5 minutes increments. A buffer containing 10% fetal bovine serum was used to stop the enzyme activity. Individual cells were obtained by gently mechanical disruption using a pipette tip. An identical protocol was applied to ventricles. The resulting cardiomyocytes were stained with an antibody targeting myosin (MF20, DSHB) to evaluate the preservation of the myofilaments. We found 35- and 40-minutes incubation to be the optimal time for the atria and ventricle respectively. The cells had the reported shape and a preserved myofilament structure. These single cells isolated from the adult zebrafish atria can be used in future functional studies to investigate mechanisms behind cardiovascular disease.

### Poster 99

**Presenter: Minahil Usman** (University of Utah)

Mentor: Michele Villalobos (Pediatrics)

*Evaluation of Early Intervention (EI) Referrals for Autism Spectrum Disorder (ASD) Diagnosis via TELE-PEDS and ABAS*

With 1 in 44 children diagnosed with Autism Spectrum Disorder (ASD), waitlists for evaluations across the globe are rising. Novel methods for evaluating and subsequently enrolling children in appropriate supports are needed. Evaluation allows us to examine whether there is any observable trend or relationship between scores by providers trained in EI and scores in adaptive behavior by parents, which is important to ensure improvement of symptoms in affected children within the first 3 years of life when autism is most prominent. So, as part of our research study, we evaluated Early Intervention (EI) referrals as a way to confirm an Autism Spectrum Disorder (ASD) diagnosis in children. We assessed the EI provider scores and diagnostic certainty on a level 2 ASD screener (ASD TelePeds) and then examined the relationship between scores from seven items in the TELE-ASD-PEDS assessment as well as from the Adaptive Behavior Assessment (ABAS-3). Our hypothesis was that lower ABAS scores would be positively related to TELEPEDS scores. Our findings suggest our hypothesis correct, with 9 out of 10 children having below-average scores for ABAS and also being classified with 100% certainty for ASD. This suggests that abnormal adaptive skills (i.e. reading, writing, reasoning, memory, and number concepts) could potentially help identify the early onset of autism spectrum disorder and that TELEPEDS scoring by EI providers can confirm this classification.

### Poster 100

**Presenter: Eleanor Wachtel** (University of Utah)

Mentor: Joshua Steffen (School of Biological Sciences)

*Pollinator Influence on the Microbial Composition of *O. macrocarpa* Nectar*

Pollination is a critical step in plant reproduction, essential for the cultivation of 80% of the 1400 crop plants grown around the world. Insects, specifically bees, play an integral role in the process by transferring pollen from one flower to another while taking advantage of energy sources, primarily in the carbohydrate rich nectar, produced by flowers. These abiotic and biotic interactions between pollinators and energy sources are critical for effective pollination. Current research suggests that the interactions between flowers and pollinators influence the microbial communities present in nectar. Similarly, microbial abundance and identity can be impacted by pollinator visitation. Our research attempts to refine our understanding regarding the impact of foraging insects on microbial abundance and diversity in floral nectar. Specifically, we characterize microbial communities in *Oenothera macrocarpa* (evening primrose) because of its abundance of nectar, its day-long life span, and the large quantity of pollinating insect species. Our preliminary research identified several microbial species that colonize nectar. This confirms that foraging has a significant impact on the microbial diversity in nectar and suggests that this composition is directly related to the number and types of pollinators that visit this species. Future work will focus on determining if bacteria identified in this study can impact pollinator visitation by altering the chemical cues associated with nectar. In addition, we would like to use the presence of specific microbial species to indicate and identify pollinator visitation in the absence of direct pollinator observation.

### Poster 101

## Session I 9:00AM – 10:30PM

**Presenter: Bridget Ward** (University of Utah)

Mentor: Zachary Wilson (Biochemistry)

*Regulation of the Mitochondrial Oxaloacetate Carrier Oac1*

Mitochondrial metabolite carriers are a family of proteins that transport metabolites into and out of mitochondria through the inner mitochondrial membrane. These proteins regulate the movement of metabolites into and out of the mitochondria, an organelle key in the generation of metabolic energy in eukaryotic cells. To investigate the function and regulation of mitochondrial metabolite carriers, we examined one carrier known as the mitochondrial oxaloacetate carrier (Oac1), which is a carrier involved in leucine biosynthesis. By using two different epitope tags, HA and Myc, we discovered metabolic growth conditions of *Saccharomyces cerevisiae* in which Oac1 protein levels became specifically depleted in the HA-tagged version of Oac1. In growth media lacking uracil and media lacking methionine, HA-tagged Oac1 protein levels were depleted, while nutrient-rich media and media lacking leucine caused no depletion of Oac1. This was discovered by altering metabolic growth conditions and examining the effects on Oac1 protein levels by way of Western blotting. This research provides new insight into how Oac1 protein levels are regulated and how the HA tag may alter this regulation.

### Poster 102

**Presenter: Cory Watts** (Utah State University)

Mentor: Dean Tantin (Pathology)

*Mutagenic Analysis of Oct4 Phosphorylation Site Significant in MORE DNA Binding*

Oct/POU family transcription factors are important regulators of mammalian development. Previous research has investigated binding interactions between the prototypic Oct protein Oct1 to its consensus octamer and variant MORE DNA sequences, as a monomer and dimer respectively. Similar interactions have been shown between the pluripotency master regulatory protein Oct4 and the same sequences. Different sites of phosphorylation have been shown to impact the binding ability of Oct1, and our research explores the impact of a similar site on Oct4's binding ability. Specifically, we introduced an S229D mutation in a bacterial protein expression plasmid through implementation of overlapping PCR mutagenesis. We then transformed bacterial cells with this plasmid containing the gene for the mutant Oct4. After culturing bacterial colonies with this mutation, we collected and purified the plasmid. Mammalian expi-293 cells were then transfected with this plasmid and were used as means to produce the protein product. Tags included in the gene for the Oct4 protein allowed for its purification. With this purified product, we were then able to compare its binding capacity to that of wild-type Oct4 protein through the use of electrophoretic mobility shift assay (EMSA). EMSA uses a short stretch of fluorescently labeled DNA as a probe with which the protein can interact. Complexes of protein and DNA probe migrate through the gel based on their size, with the large complexes traveling slower. Analysis of the gels suggested that the binding efficiency of the S229D mutant Oct4 seems to decrease for both octamer and MORE sequences relative to the wild type protein. Additionally, decreased levels of protein expression were noticeable for the mutant relative to the wild type protein. Further research is needed to better understand what impacts this particular mutation has on the Oct4 structure and functionality, and how that may account for the observed differences.

### Poster 103

**Presenter: Cambria White** (North Carolina Central University)

Mentor: Derek Mallia (Atmospheric Sciences)

*Identifying Sources of Methane Leaks in the Bountiful/North Salt Lake Area*

Methane (CH<sub>4</sub>) is a greenhouse gas that is 25 times more potent than Carbon Dioxide (CO<sub>2</sub>) and highly efficient at trapping heat in the atmosphere. Since the start of the industrial revolution, atmospheric methane levels have been rising primarily due to increased emissions from anthropogenic sources. Examples of these sources include oil and natural gas systems, wastewater treatment facilities, landfills, and various industrial processes. Among the many anthropogenic sources of methane, there are also natural sources of methane. During a MethaneAir pass over of the North Salt Lake area on August 11th, 2021, a notable methane plume was observed. The objective of this research was to determine the potential sources of this methane plume using a combination of meteorological simulations generated from the Weather Research and Forecast model (WRF) and nearby wind measurements obtained from MesoWest. The results generated from this analysis indicate that WRF was able to accurately reproduce winds across the study domain when evaluated with local wind measurements. Overall, the meteorological analysis present here suggests that winds across the study domain were stagnant, indicating that the source of the methane plume was likely local. We hypothesize that the methane plume originated from a local gas refinery. Pinpointing local sources of methane will be important for leading future efforts to quantify methane leaks and for determining how these individual methane leaks might contribute to global increases in methane concentrations that we are currently observing.

### Poster 104

**Presenter: Christian White** (Southern Utah University)

Mentor: K.C. Brennan (Neurology)

*Influence of Altitude on Migraine Aura in Mice*

Two billion people worldwide suffer from headache disorders including migraine. Migraine is characterized as localized pain typically on one side of the cerebral cortex. Approximately 30% of migrainers experience aura; characterized by sensitivity to light, nausea, spotty

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vision, etc. Spreading Depolarization (SD) is a slowly propagating wave of near-complete depolarization that underlies aura in the cortex of migraineurs. A common mechanism of SD initiation includes hypoxia because the sodium-potassium pump is working ineffectively. In hypoxic conditions, much Glutamate gets released, hyperexciting the cell causing SD. Clinical data shows that altitude may be the cause for over 50 million migraines. More lab research needs to be conducted to better understand the mechanisms of altitude-induced migraine. Our prediction is that higher altitude mice have higher susceptibility to SD. We're using SD as our biomarker because of its prediction for migraines. Methods include putting mice in one out of three altitude chambers for 10 days. The three altitude chambers represent; sea level (0 m), local altitude (1400 m), and high altitude (4500m). After altitude exposures, SD susceptibility is examined in vivo. An open field test is being conducted on the mice while in the chambers. After the mice are removed from the chamber Animal Tracker is used to assess anxiety in the mice. Thus far, our data shows that high and local altitude mice have increased susceptibility to SD compared to sea level mice (4500m,  $P=0.0002$ ; 1400m,  $P= 0.02$ ;  $n = 16-17$  mice). The open field test is awaiting results. Results suggest that humans are more susceptible to migraine aura at increased altitudes.

### Poster 105

**Presenter: Clara Wiesler** (Vassar College)

Mentor: Caroline Saouma (Chemistry)

*Hydrogenation of Carbon Dioxide to Methanol using Cobalt Catalysts*

With greenhouse gas emissions increasing, it is essential that sustainable methods of producing methanol - a precursor for many chemicals and fuels - be researched to ultimately eliminate the need to burn fossil fuels. Previous research has identified that when cobalt is mixed with the organophosphorus ligand triphos, it can hydrogenate carbon dioxide to methanol. Building upon this work, we have synthesized a variety of (triphos)Co(I) catalysts and tested them for catalysis. To investigate the catalytic cycle these complexes undergo, we have attempted multiple pathways to synthesize cobalt(I) and cobalt(II) hydrides and will ultimately test these hydrides for catalysis. It is necessary to synthesize a well-defined catalyst and identify its mechanism so that carbon dioxide can be hydrogenated to methanol most efficiently.

### Poster 106

**Presenter: Breanna Wong** (University of Utah)

Mentor: Yong Lin Kong (Mechanical Engineering)

*Transient Electronics for Biomedical Implants*

Over 27 million surgeries occur every year in the United States and 5% lead to surgical site infections. This is due to bacterial contamination at the surgical site or on the implant. Transient electronics are electronics that have the ability to disintegrate safely in the body. This project focuses on how transient electronics can be designed to provide sensing information that can be useful for early detection. Specifically, we are developing a 3D printing process that enables the personalization of the device for individual patients.

### Poster 107

**Presenter: Elena Yee** (University of Utah)

Mentor: Micah Drummond (School of Biological Sciences)

*Intramuscular Macrophage Delivery Improves Aged Muscle Function After Disuse Atrophy*

Aging muscle and extended periods of disuse and/or injury leading to muscle atrophy compromises the immune system causing a dysfunctional macrophage response in muscle regrowth. This is especially concerning because muscle function diminishes as we age. 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, regulate/defend against infection/injury via process of inflammation and phagocytosis by releasing growth factors that play a critical role in muscle regeneration and organization. This study examines the effects of injecting young adult and aged recipient mice with pro-inflammatory macrophages into the hindlimb muscles to detect if it stimulates an immune response that improves muscle recovery following a period of disuse atrophy. The experiment involved recipient mice that underwent 2-weeks of hindlimb unloading muscle atrophy followed by a 4-day recovery period. Bone marrow-derived macrophages were isolated from three donor groups: ambulatory young adult mice, ambulatory aged mice, and 4-day reloaded aged mice. These cells were cultured in a dish, changed to pro-inflammatory macrophages, and then injected into the right hindlimb of the recipient 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. Delivery of pro-inflammatory macrophages from donor young adult or aged mice was sufficient to increase muscle function of aged mice during the recovery period. Moreover, pro-inflammatory macrophages derived from aged donor mice collected during day 4 of recovery were similarly able to increase muscle function of aged mice following disuse. Together, these results suggest that macrophage immunomodulation approaches in the form of ex vivo pro-inflammatory macrophage during the early recovery phase following disuse atrophy were sufficient to restore the loss of aged skeletal muscle function.

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### Poster 108

**Presenter: Daisy Zapata** (Quinnipiac University)

Mentor: Michelle Debbink (Obstetrics & Gynecology)

*Ensuring Data Sovereignty with Qualitative Data for American Indian/Alaska Native Communities*

Data sovereignty principles have taken on growing importance in the context of research with and for Indigenous communities. However, limited data to guide the ways in which data sovereignty principles could be applied to qualitative data. To develop a better understanding of how to ensure data sovereignty principles are followed during qualitative research regarding maternal morbidity and mortality, conducted with and for American Indian/Alaska Native communities in Utah. We recruited stakeholders from each our research partners representing Native communities in Utah; these partners had been involved in disseminating information about focus groups to understand maternal morbidity and mortality among Native women in Utah. We conducted 30-45 minute interviews with interview questions focused on data sovereignty principles, and the desires of each community in terms of how best to return data to the groups that contributed it. Interviews were conducted by phone, recorded, and transcribed. The transcripts were reviewed for recurrent themes using grounded theory methodology. Preliminary data suggest that Indigenous communities seek autonomy over their data. Open dialogue with research teams is valued, especially within the context of continuous relationships that are built and maintained. Qualitative data should be returned to tribes both as a summary of important themes, as well as representative quotes that can be used by tribes to bolster their own work in the future. Practicing data sovereignty principles can increase the effectiveness and reach of research by bolstering partnerships with Native communities and by increasing the ways in which results are employed to create change in health outcomes.

### Poster 109

**Presenters: Camden Alexander** (University of Utah) and **Monica Owens** (University of Utah)

Mentor: Scott Collingwood (Pediatrics)

*Interventional Assessment Of Air Quality On Low-Income Homes In Salt Lake County*

The Salt Lake Valley is notorious for its air pollution, which occurs when harmful matter enters the atmosphere. Our air pollution consists of particulate matter (PM<sub>2.5</sub>), ozone and arsenic, which come from vehicle, home and industrial emissions. Poor air quality has been linked to adverse health outcomes such as higher rates of cancer, heart disease, stroke and respiratory diseases. The study's objective is to assess whether in-home interventions reduce air pollution and improve participant health. Methods include collecting air quality data within participant homes and implementing home-improvements, including but not limited to installing H-VAC systems and reinforcing shelter features. The study is in its elementary stages, therefore results have not been finalized.

### Poster 110

**Presenters: Marin Macfarlane** (University of Utah) and **Alicia Quick** (University of Utah)

Mentor: Amy McDonnell (Psychology)

*Effects of Natural and Urban Imagery on Error-Related Negativity*

Many studies have explored the ideas set forth by Attention Restoration Theory (ART), which proposes that exposure to nature can "restore" various aspects of attention that are depleted by our everyday, urban environments (Kaplan, 1995). Most of these studies look at different cognitive tasks that draw upon attention, showing that exposure to nature improves behavioral performance on these tasks. The proposed study will utilize electroencephalography (EEG) to measure changes in the amplitude of the error-related negativity (ERN), a brain component related to attentional control, when a participant views images of nature compared to images of urban environments. The use of EEG will allow us to explore whether neural activity is influenced by exposure to nature. This may provide further evidence of Attention Restoration Theory beyond just behavioral metrics, as well as answer the question of whether simply viewing images of nature is enough to see the restorative changes proposed by ART (as opposed to being immersed in real nature).

### Poster 111

**Presenter: Kayla Pham** (Columbia University)

Mentor: Shreya Goel (Pharmaceutics & Pharmaceutical Chemistry)

*Development of Fluorescent Ultrasmall Porous Silica Nanoparticles for Targeting Peritoneal Metastatic Tumors*

Peritoneal metastasis (PM) is advanced malignancy commonly observed in ovarian, gastric, and colorectal cancer. The current standard of care involves cytoreduction surgery and hyperthermic intraperitoneal chemotherapy with success rates being dependent on the completeness of tumor removal. However, difficulty in precise detection and complete resection of microscopic tumors is challenging. Thus, it is vital to develop imaging probes to improve cytoreduction surgeries and thereby enhance treatment outcomes. Silica nanoparticles have gained widespread interest as drug delivery systems and diagnostic imaging tools due to low toxicity, biodegradable nature, and tunable pharmacokinetics. Our lab has reported the synthesis of ultrasmall porous silica nanoparticles (UPSNs) that were rationally designed to increase tumor site accumulation while preventing sequestration by the reticuloendothelial system. In this study, we report a novel UPSN - based probe for fluorescence-guided surgery (FGS) of PM. We synthesized and characterized the UPSNs utilizing transmission electron microscopy (TEM) and dynamic light scattering (DLS) measurements. UPSN stability was monitored under various conditions over a period of 3 weeks. UPSNs were conjugated to a fluorescent dye (Cy5) and the conjugates (USPN-Cy5) were injected in a



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murine PM model of CT-26 colon cancer to test their efficacy for FGS. Our data show uniform synthesis of UPSN; hydrodynamic size  $\approx 15.31 \pm 0.35\text{nm}$  (PDI  $\approx 0.045 \pm 0.0056$ ), zeta potential ( $16.56 \pm 0.25\text{mV}$ ), and good stability over 25 days under various conditions tested. In vivo studies in CT-26 tumor bearing mice indicated that UPSN-Cy5 (HD  $\approx 14.52 \pm 0.63\text{nm}$ , PDI  $\approx 0.067 \pm 0.0072$ ) accumulated selectively at the site of metastatic nodules with reduced accumulation in off-target sites. Overall, we performed a systematic study to synthesize, characterize and biologically validate a new imaging agent. With future testing, UPSNs could hold promise as a novel intra-operative differentiation tool for molecular FGS in cancer treatment.

## SCHEDULE OF PRESENTATIONS

### POSTER SESSION II

10:30AM – 12:00PM

#### Poster 1

**Presenter: Sumeya Abdalla** (University of Utah)

Mentor: Jen Doherty (Population Health Sciences)

*What were changes in supplement use amongst women with ovarian cancer at different timepoints?*

In the United States, ovarian cancer (OC) is the fifth leading cause of cancer deaths among women and accounts for more deaths than any cancer of the reproductive system. According to the National Cancer Institute (NCI) there are an estimated 19,880 new cases that will occur in 2022 with approximately 12,810 deaths. In addition, approximately 1.1 percent of women will be diagnosed with OC during their lifetime. There is limited research when it comes to supplement use among women with OC undergoing chemotherapy. With previous research, there is little to no recommendation for supplement use for women with OC. With the information we do have, supplements are usually taken for specific deficiencies specified by a provider. It has also been identified that women undergoing further treatment for recurrence were using oral nutrition supplements such as Ensure or Sustagen or using complementary and alternative medicine (CAM) supplements such as juicing or botanical/herbal supplements. At Huntsman Cancer Institute (HCI), I am a part of the Ovarian Health and Lifestyle Study (OHLS). With the OHLS study, we look at a series of questions to get a better understanding of the supplements that participants are using, what diet changes they are undergoing, and additional lifestyle questions. I contributed to the OHLS lifestyle study by doing double data entry using the redcap database. We documented a patient's lifestyle at different timepoints, baseline, three months, six months, and one year. In the intent to change lifestyle instrument, we ask questions to determine the purpose for supplement, diet, or physical activity change and some individuals can give us why they made those changes. With the set of data received, I am interested in understanding at different timepoints, what supplements were being taken the most, if any changes occurred, and if they were recommended by a doctor.

#### Poster 2

**Presenter: Simon Alexander** (University of Oregon)

Mentor: Jessica King (Health, Kinesiology, and Recreation)

*Tobacco and Social Media: How Tobacco Companies Are Marketing on Instagram*

Instagram is a desired platform for socialization and it's been developed to promote products and a marketplace for small-owned businesses. Everything can be promoted on the app including products from tobacco companies. We wanted to investigate how tobacco products are marketed on Instagram and if different individuals interpret posts differently. Three researchers coded the top 20 posts from 10 of the most commonly used hashtags for cigarettes, e-cigarettes, cigars, and cannabis. Coding is categorizing the content of the post based on the people and products present. We coded for the following characteristics: whether people were in the posts, the degree to which posts were edited, whether the tobacco or vape products were in the post, and whether any branding was present. Overall post characteristics were summarized and responses from each of the coders were compared. We found that 67% of the posts contained people. Of the 67%, 61.3% were male and 56% were white. The level of agreement was good until we evaluated edited posts. A little more than a quarter of the posts needs to be further evaluated. The level of agreement among all the researchers was deficient at 29.6%. There could be a possibility that tobacco companies could be using young adults to promote their products, but there isn't enough evidence to support this data. Are ambiguous posts intentional for marketing strategies? If so, is it increasing the use of products? The next steps needed to be taken for the product would be to continue the evaluation of the ambiguous variables in this study by collecting more data. Also, investigation on the process of surrogate advertisement and its association with smoking and cancer rates.

#### Poster 3

**Presenter: Lydia Altamiranda** (University of Utah)

Mentor: Ali Palmer (Psychology)

*The Influence of Parental Perceptions and Behavior on Child Sun Protective Habits*

Melanoma, which is deadly, affects thousands of children. Sun-protective behaviors in children are linked to a number of modifiable attitudes and behaviors in parents. Parents who were intentional about keeping their children sun safe report positive attitudes toward and high sun-protective behaviors likely contributing to their child's positive perception of sun protection (Hamilton & Kirkpatrick, 2017). This relationship is key to lowering sunburn occurrence in children and reducing the risk of melanoma later in life. Parental modeling and the impact on their child's use of sun-protective behaviors were assessed. IBM's SPSS Statistical Analysis Software was used to assess the correlations between parents' self-reported sun-protective behaviors and child's sun-protective behaviors. Some of these behaviors included tanning, wearing hats or sunglasses, sunburns in the past month and year, and time spent outside during UV peak hours. Correlations were

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created from 276 participants, which comes from a larger randomized controlled trial that focuses on melanoma survivors (parents) and their children. The questionnaire asked about their sun-protective behaviors and their child's sun-protective behaviors. The data collected was from the past year as well as the past month. There is a statistically significant correlation between parent sun-protective behaviors and child sun-protective behaviors for sunscreen use, tanning, and wearing sun-protective clothing. Parent-reported use of problem-solving with their child about sun protection behaviors was significantly correlated with child sunburn occurrence. Correlations between perceived risk of melanoma and child sunburn occurrence were not significant. These results show the impact that a parent has on their child regarding sun-protective behaviors. It identifies key challenges for future studies on sun-protective behaviors. Future directions would include strategies for increasing participant completion rates, the effect of parent gender on children's sun-protective behaviors, and clinical trials at pediatric offices.

### Poster 4

**Presenter: Shira Archie** (Illinois State University)

Mentor: Randall Peterson (Pharmacology and Toxicology)

*Modeling Rare and Undiagnosed Diseases in Zebrafish to Identify Potential Therapeutics*

An estimated 7000 distinct rare diseases exist and collectively affect about 8% of Americans. Included in this estimate are patients with undiagnosed diseases for which treatment is rarely available. Advances in genomic sequencing technologies have offered increased genetic diagnoses; however, therapeutic treatments often remain unavailable. The objective of our research is to model rare and undiagnosed genetic diseases with the goal of identifying potential therapeutics. Zebrafish are a promising model organism for this purpose. To demonstrate this, we are generating zebrafish models of four previously undiagnosed genetic diseases identified at the University of Utah. We used CRISPR/Cas9 mutagenesis to generate and identify mutant alleles in *sgms2a/b*, *mmp2*, *pik3c3*, and *prps1a*, zebrafish genes orthologous to those identified in patients. We are phenotypically characterizing these lines and performing high-throughput chemical screens focused on suppressing mutant phenotypes that correlate with patient symptoms. We have demonstrated efficient mutagenesis in all genes of interest, and identified nonsense germline mutations in *mmp2*, *pik3c3*, and *prps1a*. Phenotypic characterization of *mmp2* and *pik3c3* mutants is underway. Finally, previously described *prps1a* mutant zebrafish display disease relevant phenotypes allowing chemical screening. We anticipate screening ~1200 chemicals; halfway through this screen we have identified one hit compound which rescues pigmentation defects in *prps1a* mutants. We are currently validating this hit and assessing its ability to rescue other disease relevant phenotypes, such as sensorimotor deficits seen in behavioral assays. This pipeline of disease modeling and therapeutic screening could prove monumental for many people in the world.

### Poster 5

**Presenter: Maxwell Austin** (University of Utah)

Mentor: Andrew Roberts (Chemistry)

*Antimicrobial Peptide Stabilization and Natural Product Scaffold Mimicry Using Triazolinedione-Based Cyclization Methods*

Antimicrobial peptides (AMPs) are a promising, yet underdeveloped class of therapeutics with structural characteristics that go beyond traditional drug discovery guidelines. Though structurally diverse, most AMPs have defined peptide secondary structures that promote their mechanisms of action. A common hypothesis is that the stabilization of these peptide secondary structures may enhance their biological properties. The main goals of this project involve the development and application of a selective cyclization reaction to stabilize and mimic the cyclic structures of these bioactive peptides. Triazolinediones (TADs) are reactive molecules with remarkably selective chemical reactivity that have enabled applications in organic synthesis, chemical biology, and medicine. Substituted TADs are used for tyrosine-selective bioconjugation reactions that satisfy 'click reaction' chemical requirements. TAD-containing peptides can react selectively with tyrosine (Tyr) to yield TAD-Tyr linked cyclic peptides. Toward antimicrobial peptide therapeutic discovery, I will use TAD-based cyclization methods to stabilize and mimic the structures of the bioactive peptides magainin and arylomycin. The magainins are naturally produced helical AMPs isolated from the African clawed frog that exhibit Gram-negative antimicrobial activity. Using an electrochemical oxidation method I will prepare a series of structure-stabilized magainin peptides and evaluate their biological properties. The naturally produced arylomycin AMPs are structurally defined by a smaller, biaryl-linked cycle. Here I will use on-resin TAD-based cyclization chemistry to prepare a close mimic of the biaryl-linked cycle. Long-term, the development of TAD-based cyclization methods for the stabilization and mimicry of peptide secondary structures could expand future access to stable peptide therapeutics.

### Poster 6

**Presenter: Jenna Birchall** (Brigham Young University)

Mentor: Elizabeth Keating (Pediatrics)

*Pediatric injury care successes and challenges in Northern Tanzania from the health care provider's perspective*

Low- and middle-income communities suffer greatly in the ability to provide adequate health care for trauma injuries in children. This is one of the difficulties that makes injury the leading cause of morbidity and mortality in low- and middle-income countries. The operations of treatment centers often impedes the recovery of the injured children. The purpose of this study was to identify the impediments and the successes in pediatric trauma care in the Kilimanjaro Christian Medical Center (KCMC) located in Moshi Tanzania. In this study, focus groups were conducted in order to examine what are the difficulties and successes in pediatric trauma healthcare. The five focus groups

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were composed of various health care providers from the emergency department, the burn unit, the surgical teams, and the general hospitalized children. The health care providers were interviewed and questioned about their experiences providing care in the low income environment. Throughout these interviews, themes were recognized and highlighted that identify the success and challenges faced in middle-to low-income countries. Challenges that impeded the child's care included delays in seeking definitive care, the personnel quantity and the previous training, non definitive care guidelines, limitations in resources, difficulties in transferring between wards, proper at home and follow up care, and cultural and financial barriers faced by the guardians of the patients. Successes were found in the team work of the health care providers, better resources available at KCMC versus other health centers in the areas, and the prioritizing that occurs when a pediatric injury enters the center. These focus groups were able to highlight the challenges and successes that occur on the frontlines of a low- and middle-income countries pediatric trauma patients.

### Poster 7

**Presenter: Riley Bird** (Yale University)

Mentor: Corrine Welt (Internal Medicine)

*Association between the Gene DIS3 and Primary Ovarian Insufficiency*

Primary Ovarian Insufficiency (POI) affects approximately 1% of women with little known causally. In POI, women experience low estradiol, high follicle stimulating hormone levels, and ovarian dysfunction or failure before 40 years of age. In extreme cases, some might never experience a period or puberty. There is likely a genetic reason for most cases. A whole exome sequencing of DNA was conducted on two girls diagnosed with POI and the mother and father. Data demonstrated a genetic mutation in the mother and father, confirmed by Sanger sequencing. A missense and deletion in DIS3 in both affected girls was found, with each mutation inherited from one parent. In the missense, arginine changed to threonine at amino acid 781 where C mutated into G (Arg781Thr) and in the other an in-frame deletion of three bases pairs occurred which correlates to an arginine deletion(Arg626del). Studies in *S. cerevisiae* demonstrate that DIS3 acts as a gene silencer. When DIS3 was not present, the yeast accumulated RNA transcripts that correlated to naturally silent elements. The identified mutations are found in highly conserved amino acids important for RNA binding and negatively affected RNA silencing, impacting protein cleanup and creation. Leading to the cell's inability to maintain genomic integrity. We will now use a model in *Drosophila* to determine how the disruption (or knockdown) of the DIS3 gene will affect the ovaries. We hope this model will tell us whether the DIS3 gene has a role in ovarian function and we will continue to work on furthering our understanding of the gene from here.

### Poster 8

**Presenter: Jasper Bradford** (University of Utah)

Mentor: Vikram Deshpande (Physics & Astronomy)

*Non-Uniform Strain in Twisted Bilayer Graphene*

Twisted bilayer graphene, discovered about four years ago, has proved to be an interesting 2-dimensional system. Because the small-angle twisting between two graphene layers creates unit Moiré superlattice cells of roughly the same size as the magnetic length for a perpendicular magnetic field of several Tesla, the Hofstadter butterfly spectrum can be observed. When the twist angle is at 1.1 degrees, also known as the 'magic angle', it exhibits superconductivity, correlated insulating states, and ferromagnetism. As a 2-D lattice, it is also a possible candidate for discovering pseudo-magnetism via non-uniform strain. Pseudo-magnetism has been witnessed in very local regions due to strain from nanoparticles on device substrates, but has never been created on a large scale. In our experiment, we utilized a flexible substrate to investigate the effects of isotropic strain on the transport properties of TBLG. Now, we will use a triangular profile to create the requisite non-uniform strain on the device and possibly observe pseudo-magnetism over an entire device.

### Poster 9

**Presenter: Katie Breeland-Newcomb** (Bennington College)

Mentor: David Kieda (Physics & Astronomy)

*Resolving the Binary System Spica using the VERITAS Stellar Intensity Interferometer*

In 2019, the Very Energetic Radiation Imaging Telescope Array System (VERITAS) was augmented with high-speed optical electronics to allow for Stellar Intensity Interferometry (SII) observational capabilities. This research shows how VERITAS-SII (VSII), which measures correlations of starlight intensity fluctuations across spatially separated telescopes, can enable the characterization of binary stellar systems. We first use VSII data collected on the binary star Spica to develop a dynamic analysis technique. We then simulate the squared visibility curve given a particular orientation of Spica's components. Because of Spica's 4.0145-day period, the orientation, and therefore the simulated squared visibility, varies greatly from night to night. These variations are seen in the measured squared visibility curves. The initial results indicate that VSII observations potentially demonstrate good sensitivity to the evolution of the Spica binary system.

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### Poster 10

**Presenter: Jacob Burke** (University of Utah)

Mentor: Michael Free (Metallurgical Engineering)

*Effect of Stirring Rate on Bio Oxidation Rate in Pyrite Bio Oxidation*

Pyrite is the most common sulfide mineral, accompanying many valuable minerals such as galena chalcopyrite, and importantly, Rare Earth Element deposits. Pyrite naturally oxidizes over time producing sulfuric acid, which can contaminate the environment surrounding a mine site. Bio oxidation of pyrite results in the production of sulfuric acid in a more controlled manor, allowing the sulfuric acid to be used in other processes such as leaching. Research was conducted in a 3l bioreactor with various controlled parameters including, temperature, air flow, residence time, stirring rate, and percent solids. Most of the parameters have been optimized, however this research focused on stirring rate. The most relevant measurement taken from the bioreactor was bio-oxidation rate, which is a measurement of the rate of reaction. The bio-oxidation rate seems to have reached a maximum of 3.66 g/l/hr at 650 RPM. However more research needs to be conducted to fully understand the curve of bio-oxidation rate vs. stirring rate. Once the stirring rate has been optimized, the next parameter to focus on will be air flow.

### Poster 11

**Presenter: Michelle Cao** (University of Utah)

Mentor: Jordan Gerton (Physics & Astronomy)

*Student Interactions and Group Dynamics within Reformed Introductory Physics for Life Science Laboratory (IPLS) Courses*

The undergraduate physics labs for life science majors at the University of Utah utilize the 3-dimensional learning approach to better support student learning of scientific practices and physics. Within this instructional approach, students are given more agency in directing the experimental planning and implementation, emphasizing scientific thinking. However, providing students with free agency to form groups and self-delegate tasks can present learning gaps amongst students in vulnerable social groups (women, students with disabilities, LGBTQ+ students, and BIPOC students, among others). With qualitative data from screen capture audio and visual recordings as well as video recordings of this laboratory setting, we can study student interactions in delegating roles that can be gendered in nature. For example, students that present as female will oftentimes be assigned the role of the scribe or task manager. Studying these interactions can provide insight into where biases might limit student participation.

### Poster 12

**Presenter: Lillee Casselman** (University of Utah)

Mentor: Caroline Saouma (Chemistry)

*Feasibility of triphos-ligated cobalt as an electrocatalyst for carbon dioxide reduction*

In the wake of increasing concern and awareness surrounding global warming, there is a strong push to not only reduce carbon dioxide emissions, but also to advance technologies that negate emissions. One plausible way to do this is through conversion of carbon dioxide to fuels or fuel precursors (carbon monoxide, methanol, formic acid). Very few catalysts can convert carbon dioxide to methanol, one of which is triphos-ligated cobalt; this species has been shown to hydrogenate carbon dioxide to methanol under elevated temperatures and pressures. Knowing that the same catalyst can electrocatalytically reduce protons to hydrogen gas, my project is focused on determining if triphos-ligated cobalt can also serve as an electrocatalyst for carbon dioxide reduction. Using very weak acids, we can circumvent hydrogen gas production at mild potentials, and access a catalytic current that is pronounced in the presence of both carbon dioxide and protons. My presentation will discuss these findings, as well as proposed intermediates that I have characterized. This work will be contextualized in terms of how carbon dioxide electrocatalysts relate to carbon dioxide hydrogenation catalysts, which may provide strategies for future catalyst designs.

### Poster 13

**Presenter: Justin Chen** (University of Utah)

Mentor: Adrian Rothenfluh (Psychiatry)

*Exploring the Effects Alcohol Has on 3R579 and 2L631 Neurons in Drosophila*

One of the most addictive and abused substances to humans is alcohol. Alcohol use disorder (AUD) is characterized by uncontrollable drinking and dependency on alcohol, which leads to negative consequences on an individual's health and safety. Not only does alcohol affect an individual's health and safety, but also their sleep in ways we do not quite understand. In 2019, according to a national survey, about 14 million individuals above 18 years old had AUD. Despite high rates of use and abuse, there are many open questions about how alcohol affects the human brain. To study the effects of alcohol on the brain we will use *Drosophila Melanogaster* (common fruit fly). The fruit fly shares 61% of known human disease genes and behavioral similarities when intoxicated making it a great organism to study. Previous work in the Rothenfluh lab suggests that the 3R579 and 2L631 neurons in *Drosophila* are linked to some responses to alcohol. Similarly, the Rothenfluh lab has shown that the fly insulin receptor pathway, including overexpression of part of this pathway, Phospholipase D (PLD), is involved in alcohol responses. I can therefore ask whether overexpression of PLD in 3R579 or 2L631 neurons impacts fly behavior, including alcohol responses, sleep, and alcohol-induced sleep effects. To test this, I used the GAL4/UAS system to

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cross Gal4 driver lines for 3R579 or 2L631 to UAS effector lines overexpressing PLD. To test alcohol responses, I will use a Maples assay for sensitivity and tolerance, and I will assess sleep using the Drosophila Activity Monitoring System. From finding show, there seems to be a resistance phenotype found within 3R579 neurons and a change in sleep latency when induced with alcohol in both of these groups of neurons. Overall, even though there does not seem to be a sensitivity phenotype found within these neurons and there may be some effect on their sleep, more testing must be done in order to confirm these results.

### Poster 14

**Presenter: Tacy Christensen** (Utah State University)

Mentor: Nathan Clark (Human Genetics)

*Characterizing HIF-pathway alteration and molecular response to hypoxia across extant basal metazoans (Ctenophora, Porifera)*

Low oxygen, or hypoxia, is encountered by almost all species on earth and metazoans have developed specific mechanisms to deal with it. The Hypoxia-Inducible Factor (HIF) pathway regulates a majority of these specialized mechanisms. It has been shown via previous studies that the most basal of metazoans (sponges, ctenophores, placozoans) are tolerant of hypoxia even at extreme levels, but the individual mechanisms of these metazoans have not been compared, or in some cases studied. The few studies on this have suggested that there are differences to the HIF-pathway, but a thorough examination of this pathway through an assessment of transcriptome patterns is necessary. This project assesses the presence of members of the HIF-pathway in 15 ctenophore and 15 sponge species. To further investigate we also subjected the ctenophore *Mnemiopsis leidyi* to hypoxia for an extended period of time to gain an understanding of mechanisms in play due to hypoxia and compared it to a sponge (*Tethys wilhelema*). Our findings confirm that basal metazoans have a majority of the HIF-pathway intact, but that they have lost some of the repression machinery which may explain why they are so tolerant of hypoxia.

### Poster 15

**Presenter: Payton Compton** (Ohio State University)

Mentor: Joseph Bednarek (School of Biological Sciences)

*DNA Barcoding of *Cryptococcus neoformans* to understand pathogen dissemination*

*Cryptococcus neoformans* is an opportunistic fungal pathogen that causes lethal meningoencephalitis in immunocompromised populations. There are an estimated 215,000 cryptococcal infections per year, with a mortality rate of 30-70% and a high prevalence in areas of limited medical infrastructure, such as Africa. Dissemination and organ seeding of *C. neoformans* are poorly understood. Since the disseminated brain infection is the primary cause of mortality, studying these aspects of pathogenesis is crucial to developing new therapeutics. The purpose of this research is to insert a 12-base pair segment of DNA into the fungal genome that acts as an identifying "barcode" to track fungal dissemination. We will use barcoded fungi to study organ seeding, the colonization of organs by fungi. We hypothesize that seeding events are rare early in infection and increase in frequency later in infection.

We used cloning and Gibson assembly to create a barcode bound to an anti-fungal resistance cassette integrated into a plasmid. Using PCR, we amplified this segment and inserted it into a genomic safe haven (SH2 locus) of *C. neoformans* using CRISPR-Cas9. Through serial plating on anti fungal media, we selected for barcode-containing fungi and then sequenced the barcoded strains to confirm insertion into the SH2 locus.

We were able to create several barcoded *C. neoformans* strains with SH2 locus insertion.

CRISPR-Cas9 was used to insert a DNA barcode into the fungal pathogen *C. neoformans*. We will use these barcoded strains in subsequent studies to define the kinetics of organ seeding and dissemination.

### Poster 16

**Presenter: Noah Conner** (University of Utah)

Mentor: Vikram Deshpande (Physics & Astronomy)

*Anthracene use in the fabrication of van der Waals heterostructures*

The study of van der Waals (vdW) heterostructures is on the forefront of condensed matter physics. vdW heterostructures are constructs of stacked 2-dimensional materials such as graphene, superconductors, and topological insulators. Given the recent discoveries in the electrical and mechanical properties of vdW heterostructures, we are interested in creating and fine-tuning suspended film systems that facilitate novel electromechanical devices and deeper study of fundamental physics. This work explores the viability of the organic crystal anthracene as a sacrificial layer during the fabrication of vdW heterostructures composed of graphene, hexagonal boron nitride (hBN), and the topological superconductor Fe(Te,Se) (FTS). This would allow for the dry and deterministic transfer of these heterostructures as suspended samples, which has proven incompatible with wet fabrication methods. We experimented with several different fabrication procedures, making use of anthracene's consistent sublimation at 110° C. We adjusted several variables within the process, including temperature and contact time, as well as testing crystals with various different physical characteristics. Anthracene proved to produce the precise and clean transfers that could further advance the research of suspended vdW heterostructures. However, it was only able to consistently pick up hBN flakes off of the necessary SiO<sub>2</sub> substrates, while not picking up graphene and FTS. The use of anthracene does not currently seem to be a viable method to study suspended graphene and FTS samples, but the clean, dry, and deterministic transfer of hBN shows that this method has the potential to help study vdW heterostructures in the future.

**Poster 17**

**Presenter: Meghan Crowther** (Brigham Young University)

Mentor: Quang-Tuyen Nguyen (Pediatrics)

*Pediatrics Behavior and Development Training Materials through the Lens of Identity, Diversity, and Inclusion*

Medical training texts may be written with inherent implicit bias. If not acknowledged, bias in medical text can especially have repercussions in clinical decision-making. Existing research on diversity, equity, and inclusion (DEI) in training tools analyzes the effect of postgraduate or employment-based trainings or focuses on disciplines such as surgery or dermatology in which biases are more overt. There is a need to address bias earlier in medical curricula. In particular, pediatric behavior and development texts are vulnerable to cultural and demographic intersections in bias. Themes represented in the text may reflect medical and cultural biases in values; this has yet to be examined in the literature. In this qualitative study, key themes in medical text vs. parenting resources from various cultural perspectives were examined. The gap between value systems in medical and cultural approaches to educational materials about behavior and development was explored. Demographics were examined to determine sources of non-medical parenting materials and contrasted with Nelsons Textbook of Pediatrics. A qualitative analysis of key themes by lines of text represented in Nelsons was done by two raters, centering on behavior and development in early childhood. Emerging themes included cultural acknowledgment, social determinants of health, parenting, opportunities to discuss cultural values, child response and adaptability, and independence and individualism. Comparison between parenting materials from a Native American perspective and a Hispanic perspective showed overlapping themes, but contrasted with medical themes. Parenting texts especially approached the concept of identity in differing ways. Discussion of environment in the medical text was heavily influenced by social determinants of health in the context of trauma, in contrast to parenting materials that underscored the positive influence of community. There is a clear gap between parenting materials and medical text. If this gap can be addressed, pediatricians will better meet the needs of patients.

**Poster 18**

**Presenter: Pamela Cubias** (State University of New York at Albany)

Mentor: Peter Veals (Atmospheric Sciences)

*Examining how complex terrain in the western United States and the diurnal cycle drive deep convection during the North American Monsoon season*

The North American Monsoon (NAM) is defined as a seasonal shift in atmospheric circulation that accounts for most of the rainfall in the southwestern United States. Previous studies support the indication of the shift of westerly winds to more southerly. Correspondingly, the subtropical ridge is pushed northward, driving low-level moisture from the Gulf of California. Additionally, due to continental heating, a thermal low develops over the desert southwest increasing the pressure gradient force from the east to the southeast (Hawks, 2015). Under these conditions, we examine how the complex terrain that dominates in the western United States and the diurnal cycle drive the convection during the monsoon season and affect the variability.

For the purpose of this study, we focus on southern Utah, utilizing data from the NWS NEXRAD at Cedar City. We examine the frequency of occurrences (FOO) of deep convection with reflectivity > 20 dBz at different vertical levels (0km, 1km, 2km, etc.) from July to mid-September between 2018-2021. Analyzing the FOO in 3-hour intervals, we concluded that at higher terrain, deep convection is at peak intensification during the late evenings between 0400z and 0700z. However, we noticed that the highest peak (~1200ft), shows little to no convection. During the early mornings, 0700z-1000z, convection is distributed throughout the region, with approximately equal intensities between the higher and lower boundaries.

Evidently, we noticed that the topography in the region and diurnal cycle not only determines the location of frequent deep convection but also the intensity. The predominant existence of deep convection arises in late evenings and early mornings over different elevations, observing greater intensity over higher terrain. Nonetheless, we also have evidence of the highest elevations showing little to no convection. Overall, forecasting and acquiring consistent patterns of precipitation during the monsoon season is an ongoing challenge for researchers.

**Poster 19**

**Presenter: Rachel D'Agostini** (University of Utah)

Mentor: Xuming Wang (Materials Science and Engineering)

*Production of High-Purity Calcite and Rare Earth Elements from Phosphogypsum*

Phosphogypsum (PG) is a solid waste from phosphoric acid production, and is primarily composed of  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ . It is estimated that about 200 Mt/a of PG is generated globally in the phosphate industry (Parreira et al. 2003). Due to impurities (such as phosphate, fluorides, sulfates, trace metals and radioactive elements) only 15% of the PG is recycled as building material and soil stabilization amendments (Tayibi et al. 2009). Most of the PG is stored in large stacks across the world. The large number of PG stacks is not only occupying land space, but is also an environmental problem (Rutherford et al. 1994, 1996). On the other hand, the PG could be a material resource. For example, research indicates that the content of REE (Rare Earth Elements) in PG is about 112-300 ppm (Zhang 2014) which is a significant REE resource.

Current study for recovery of REE from PG using  $\text{NH}_4\text{Cl}$  dissolution is in progress. In addition, preparation of high purity of  $\text{CaCO}_3$  through  $\text{CO}_2$  mineralization is included in our research (Figure 1). The processing parameters including dissolution time, temperature, and liquid/solid ratios are being explored to determine the optimum conditions. Fourier-transform infrared spectroscopy (FTIR) is being used

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to examine the products, and a  $\text{Ca}^{++}$  ion selective electrode is being used to observe dissolution and carbonate formation processes. The preliminary results show the feasibility of using the PG dissolution -  $\text{CO}_2$  mineralization process to recover REE and produce  $\text{CaCO}_3$  from PG. The advantage of this processing is to use the solid waste PG and greenhouse gas  $\text{CO}_2$  as feed materials to produce valuable products, REE and  $\text{CaCO}_3$ . Future research will include extraction of REE from solution.

### Poster 20

**Presenter: Kamarie Dalton** (Southern Utah University)

Mentor: Anna Beaudin (Internal Medicine)

*Prenatal Folate Status Influences Hematopoietic Stem Cell Function*

Folate is an essential B vitamin (B9) that programs risk for developmental diseases such as neural tube defects in a developing fetus as well as adult-onset diseases associated with inflammation. Healthcare professionals advise pregnant women to take a folic acid supplement during the first trimester. Folic acid intake can vary from deficiency to over supplementation in different populations due to socio-economic status, nutrition intake, and common genetic variation. Folate-mediated one-carbon metabolism (OCM) directly regulates critical cellular processes, including all cellular methylation reactions, de novo nucleotide biosynthesis, and mitochondrial metabolism. These processes regulate the establishment and function of hematopoietic stem cells (HSCs). To test the effect of prenatal folate status on HSC development, wildtype female mice were fed an experimental diet to model folate variability within the population: 0mg/kg (deficient FD), 2mg/kg (control FC), and 8mg/kg (supplemented FS) and bred at 8 weeks of age. To test prenatal folate status on HSC function, competitive transplantation assays were performed using purified HSCs isolated from adult offspring born to females maintained on experimental diets. We measured chimerism every 4 weeks for 20-weeks post-transplantation by peripheral blood analysis in recipient mice and determined in all BM populations at 20 weeks. There were no differences between FD and FS offspring compared to the FC as measured by donor chimerism in any peripheral blood lineages. However, the contribution of donor HSCs to myeloid, B- and T- cell lineages was increased in FS offspring as compared to FC, indicating there was a lasting effect of folate supplementation on HSC function. This preliminary data shows that prenatal folate supplementation can have lasting effects on HSC function. Ongoing studies using RNA-seq and ATAC-seq will provide further insight into how manipulation of prenatal folate status regulates genomic methylation and transcriptional activity and its implications for HSC self-renewal and lineage commitment.

### Poster 21

**Presenter: Abbie Darling** (University of Utah)

Mentor: Andrew Roberts (Chemistry)

*Synthetic Handles to Peptide Synthesis*

Peptides and proteins are essential components for sustaining life. Synthetic methods for their production are needed to enable investigations into their structure and function. Typically, peptides are made using solid-phase peptide synthesis (SPPS) techniques to efficiently access peptides up to approximately 50 amino acid residues long. These fragment peptides are then used to access longer peptides and proteins through a selective coupling reaction known as native chemical ligation (NCL). NCL achieves this site selectivity from the reaction of a C-terminal thioester and N-terminal thiol. However, cysteine is one of the least abundant amino acids, and it can be difficult to adapt to challenging sequences with current methods. Our research aims to synthesize derivatives of natural amino acids that can be incorporated during routine SPPS and enable NCL with an appended thiol auxiliary. Access to these amino acids would provide a wider range of adaptability in the synthesis of peptides and proteins.

### Poster 22

**Presenter: Shane Denherder** (University of Utah)

Mentor: Elisabeth Conrads (Psychology)

*Comparing Modalities - physiological responses to online vs. in-laboratory tasks*

The COVID-19 pandemic has introduced new difficulties in keeping participants and research assistants safe during lab visits, forcing many researchers to alter their data collection protocols. Many labs have adapted previously-validated research tasks and experiments to online platforms. The present study compares the physiological effects of an online adaptation of the Infant Cry Stimulus (ICS) task. The ICS is commonly used in developmental psychology to affect and measure sympathetic and parasympathetic nervous system responses to an attachment-relevant stressor in pregnant women, the infant cry.

Measuring heart rate variability (HRV) and galvanic skin conductance responses (EDA) during the ICS, we analyzed a unique sample ( $N = 114$ ) of pregnant women in their third trimester, half of whom conducted the ICS task in the laboratory before the pandemic. Analysis has shown there to be no significant differences between responses to the online ICS and in-person ICS - an exciting first step in validating the virtual task.

As other labs have adopted online protocols for remote data collection, these results demonstrate the ability of remote tasks to elicit stress responses in pregnant women from the comfort of their homes. Future studies in developmental science will be able to recruit from a



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more diverse population of participants including rural or otherwise underrepresented populations unable to travel to large research facilities.

### Poster 23

**Presenter: Qootsvenma Denipah-Cook** (Fort Lewis College)

Mentor: Katherine Deets (Human Genetics)

*Tetrahymena and Aquatic Viral Transfer*

Aquareoviruses cause hepatitis and other forms of pathogenic disease among fish, contributing to mortality in fish populations. Viral transfer, however, is not fully understood in aquatic settings. *Tetrahymena thermophila*, a unicellular eukaryotic organism that resides within the same aquatic habitats as fish and aquareoviruses, are often consumed by juvenile fish and may act as an aquatic viral vector. Recent studies showed that *T. thermophila* increases the infectious titre of chum salmon reovirus (CSV) through the process of endocytosis and exocytosis. However, the mechanism responsible for increased infectivity is unknown. Because protease treatment increases infectivity of other aquareoviruses, we hypothesize that proteases within *T. thermophila* vacuoles play an essential role in the observed increase in CSV infectious titre.

To test our hypothesis, we will determine if inhibition of protease activity in *T. thermophila* limits the increase in infectious CSV. However, we need to first understand the impact of various protease inhibitors and virus media on *T. thermophila* survival. *T. thermophila* were incubated with varying concentrations of three common protease inhibitors and found that undiluted Roche cOmplete exhibited 99% *T. thermophila* viability after 24 hours. As a follow-up experiment, we are optimizing an assay to quantify protease inhibition in *T. thermophila*. Next, we determined if *T. thermophila* were able to sustain and replicate within virus media. Ciliates in virus media with added iron had 70% viability compared to 10% without iron. These optimization experiments allow us to test the role of *T. thermophila* proteases in the increase of CSV infectivity.

### Poster 24

**Presenter: Sanyah Diaz Garcia** (Utah State University)

Mentor: Rico Del Sesto (Chemistry)

*Formulation of cannabinoids as novel transdermal materials to improve bioavailability*

Cannabinoid compounds extracted from hemp and cannabis are used by many for medicinal and recreational purposes. The therapeutic potential of cannabinoids comes from their anti-inflammatory and analgesic properties and has significantly increased the market for over-the-counter products containing CBD and other cannabinoids. Oral, transdermal, and sublingual are typical approaches to cannabinoid administration; however, these methods have seen numerous drawbacks for their poor bioavailability and inefficient drug delivery. This project aims to design and develop alternative cannabinoid formulations that will; (1) enhance the absorption by altering the physicochemical properties of the materials; and (2), devise a systemic delivery method that will maximize bioavailability to improve therapeutic potency.

Our research has focused on the formulation of cannabigerolic acid (CBGa) and cannabidiolic acid (CBDa) into new amphiphilic liquids through organic synthetic reactions. The materials were then analyzed by NMR and other spectroscopic methods. CBGa continued to be evaluated in scale-up procedures at multigram quantities to have a single lot formulation for further study by calorimetry, viscosity, partition coefficients, and transdermal permeation.

Based on the permeability of our formulation, further exploration can be done to support the development of transdermal delivery for the many cannabinoid derivatives. These new materials could potentially improve cannabinoid bioavailability significantly, leading to novel and versatile formulations of therapeutic materials.

### Poster 25

**Presenter: Kiran Echavarria** (Currently a Senior at AMES high school)

Mentor: Greg Poffenberger (Biochemistry)

*DSTAT's Critical Role on the Chemokine receptor CXCR4 and its Ligand CXCL12 Kiran Echavarria, Greg Poffenberger, Tony Pomicter, Paul Shami Huntsman Cancer Institute*

Acute Myeloid Leukemia (AML) is a deadly blood cancer, with a 5-year survival rate of 30.5% and 11,540 deaths every year. AML tends to hide in bone marrow during chemotherapy, causing cancer cells to lie dormant for years, reawakening in a patient with an immunity to chemotherapy. Dociparstat sodium (DSTAT) has been speculated in clinical trials to kill AML cells hiding out in bone marrow. We hypothesize in this experiment that we can reverse DSTAT effects on cancer cell death and restore proliferation via the CXCL12/CXCR4 pathway. We tested to see if DSTAT would interfere with the CXCL12 ligand from binding to the CXCR4 receptor on the AML cell line HL60. We simulated human bone marrow by using HS5 cell line and used HL60's to observe their reaction with the chemokine receptor CXCR4 and ligand CXCL12. We saturated our simulated bone marrow system with CXCL12 and flooded DSTAT with CXCL12 separately. We found that additional CXCL12 in our system did not stop DSTAT from killing HL60 cells by measuring the percent of CD45+ cells. We believe inhibiting the CXCR4 receptor should prevent the DSTAT effect of killing the cells. If we can determine the

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mechanism that DSTAT uses to kill cancer cells in the bone marrow, this would give the research community a pathway to target new drug development to prevent AML from evading chemotherapy.

### Poster 26

**Presenter: Sam Evans** (University of Exeter)

Mentor: Owen Chan (Internal Medicine)

*The Feasibility of Using a Novel Somatostatin Receptor 2 Inhibitor to Prevent Hypoglycemia in Type 2 Diabetes*

Loss of the ability to secrete glucagon, a hormone that is important to help raise blood glucose levels, in patients with advanced type 2 diabetes (T2D) places them at greater risk for experiencing hypoglycemia. Although the mechanism underlying this loss is currently not known, elevated somatostatin levels in poorly controlled T2D may play a role as it binds to type 2 somatostatin receptors on pancreatic alpha-cells to inhibit glucagon secretion. The current study evaluates whether a new somatostatin receptor 2 antagonist, ZT-01, can be used to help restore glucagon secretion in response to hypoglycemia in advanced T2D rats. In addition, we also examine whether ZT-01 affects metabolic parameters under hyperglycemic conditions. Sprague-Dawley rats placed on a high-fat diet and given a low-dose of streptozotocin were used to model advanced late stage T2D in humans. These animals underwent either a hyperinsulinemic-hypoglycemic or hyperglycemic clamp following the administration of ZT-01 to evaluate the effect of the drug on glucagon and insulin secretion, respectively. In response to hypoglycemia, plasma glucagon responses were almost completely absent in the T2D animals, whereas treatment with ZT-01 improved glucagon responses in the diabetic rats. Under hyperglycemic clamp conditions, we observed a significant and unexpected rise in plasma insulin levels that was accompanied by a rise in glucagon than was observed in response to hypoglycemia. Based on the data collected, ZT-01 appears to be effective at enhancing glucagon secretion in advanced T2D rats during hypoglycemia but surprisingly, it also stimulated insulin secretion under hyperglycemic conditions, which may prove to be an advantageous therapy in maintaining metabolic control in T2D.

### Poster 27

**Presenter: Taryn Evans** (University of Oklahoma)

Mentor: Joanna Grudziak (Surgery)

*Using the PROMIS framework to study intermediate and long-term outcomes among patients who survive an admission to a surgical intensive care unit (SICU): a pilot study.*

The objective of this project is to examine the utility and feasibility of using the PROMIS (Patient-Reported Outcomes Measurement Information System®) framework to evaluate and predict patient outcomes in critically ill, trauma, and emergency surgery patient populations. We administered the PROMIS-29 survey to 260 patients who were at least 18 years old and admitted to the trauma and emergency surgery service as well as the Surgical ICU at the University of Utah Hospital. The 260 patients include 130 patients from the Surgical ICU and 130 patients from the Trauma and Emergency Surgery service. All patients had to be admitted for at least 72 hours to be considered for this study. This study also included survey responses from 130 proxies for the Trauma and Emergency Surgery service patients if available in order to validate the consistency of PROMIS responses via a proxy for future use in patients who would be incapacitated and unable to answer the surveys. Proxies are people identified by the patient, someone included in intake information or via applicable legal documents. Additional studies should be done with the same inclusion and exclusion patient criteria but these future studies should include larger trials to confirm our study's results. We plan to follow these patients long-term using the same PROMIS metric to evaluate long-term outcomes and how these compare with original survey responses. Additional studies utilizing the PROMIS-29 survey to study patient outcomes in other departments is recommended to provide more data on short and long-term patient outcomes and see if our results are applicable to patients in other contexts.

### Poster 28

**Presenter: Landon Fairbanks** (Utah Tech University)

Mentor: Robert Kagabo (Family & Preventative Medicine)

*Smoking Cessation Among Psychiatric and Substance Use Patients With Comorbid Opioid Use Disorders: A Review*

Landon Fairbanks, Karina Geranios, Alyssa Ogan, Robert Kagabo, Ph.D., MPH

Background:

The rate of cigarette smoking is high among individuals with psychiatric illness and substance use compared to the general population. Individuals living with a psychiatric illness also experience high rates of opioid use disorders, with about 90 percent of opioid-dependent patients smoking cigarettes, a rate almost six times that of the general population. Cigarette smoking among psychiatric and substance use patients with comorbid opioid use disorders is a public health concern. Gaps and challenges exist in providing interventions for the

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intersection of psychiatric illness, smoking and substance use disorders, specifically opioid use disorder. This review examines smoking cessation interventions among psychiatric and substance use patients with opioid use disorders.

Methods:

We used narrative overview guidelines to search PubMed and PsycINFO for intervention studies published between 1960 and 2020. Studies used in this review must have comprised of participants with a psychiatric or substance use diagnosis with comorbid opioid use disorders. Search term examples included: smoking cessation among psychiatric patients, opioid use among psychiatric patients, smoking cessation and opioid use, smoking cessation in substance use settings, and mental health.

Results:

Based on the inclusion and exclusion criteria, ten studies were used. Participants in the studies were 50-60 percent male and smoked at least 10 cigarettes per day. Individuals with severe mental illness or substance use were generally excluded in cessation programs. Treatment periods were generally 8 weeks long and included behavioral and pharmacological interventions.

Conclusion:

This population with comorbid diagnoses is generally excluded from smoking cessation interventions. A need therefore exists for evidence-based smoking cessation interventions tailored to this unique vulnerable population.

### Poster 29

**Presenter: Natalie Flores** (Southern Utah University)

Mentor: Don Ayer (Oncological Sciences)

*Investigating the connection between glucose, TXNIP, and Myc*

Cancer cells utilize glucose to fuel biosynthetic pathways to support their high rate of cell growth and proliferation. However, this mechanism is not fully understood. Many publications indicated a crosstalk between Myc and MondoA. In the presence of glucose, MondoA activates Thioredoxin Interacting Protein (TXNIP), which inhibits glucose uptake, to maintain glucose homeostasis. One of the most important functions of Myc is to promote glycolysis and glucose uptake. A previous study in the Ayer lab demonstrates that TXNIP loss upregulates the expression of Myc target genes. In this study we reduced TXNIP expression by removing glucose from the Triple Negative Breast Cancer cell line MDA-MB-231. We then examined the effects of TXNIP loss on three Myc target genes, TOMM5, SLC20A1, and RPS21, with quantitative PCR (qPCR). Our results show that suppression of TXNIP expression with the withdrawal of glucose for 6 hours in MDA-MB-231 cells is not sufficient to increase the expression of these three Myc target genes. These results suggest that genetic loss of TXNIP is sufficient to upregulate Myc transcriptional programs but transcriptional downregulation of TXNIP has no effect on Myc dependent gene expression at least on the three targets that were tested.

### Poster 30

**Presenter: Zack Freeman** (University of Utah)

Mentor: Anil Seth (Physics & Astronomy)

*Detecting Black Holes in Omega Centauri*

My project focuses on trying to detect some of the thousands of stellar mass black holes suspected to be present at the center of Omega Centauri through gravitational lensing. Omega Cen is the most massive globular cluster in the Milky Way, therefore making it a good candidate for detection of stellar mass black holes. Past studies have shown the need for a single Intermediate Mass Black Hole (IMBH) at the center of this cluster (e.g. Noyola et al., 2010), although more recent studies have disputed this claim. Instead, Baumgardt et al. (2019) favors the presence of a cluster of stellar mass black holes near the center of Omega Cen; so far, there is no direct evidence for even a single black hole.

Omega Cen is a calibration target for the Hubble Space Telescope, and thus there is extensive imaging taken over the last 12 years. Within a single filter centered at 606 nanometers, this dataset provides about 160,000 stars with more than 100 measurements (an entire set of measurements for one star is called a lightcurve). Within these lightcurves, we are searching for a microlensing event caused by a stellar mass black hole. When a black hole (the lens) is lined up between us (the observer) and a star (the source), it causes an increase in the star's brightness; this is the microlensing event I am searching for. My work this past summer has been to model the lightcurves, including testing using synthetic microlensing events that I inserted into the data. I present a first search for potential events in this data.

### Poster 31

**Presenter: Arianna Fritz** (University of Illinois Urbana-Champaign)

Mentor: Karen Wilcox (Pharmacology and Toxicology)

*Investigating activity-dependent myelination following viral encephalitis and seizures in the Theiler's Murine Encephalomyelitis Virus (TMEV) mouse model of viral-induced epileptogenesis*

Viral infection is a major source of seizures and epilepsy, yet the mechanisms underlying the development of epilepsy following infection remain largely unknown. Seizures occur when there is an imbalance of inhibitory and excitatory neurotransmission in the brain resulting in too much excitability. Oligodendrocyte precursor cells (OPCs) are known to strengthen active circuits in the brain through their differentiation into myelinating oligodendrocytes. However, recent studies suggest that this process can become maladaptive in the process

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of epileptogenesis, contributing to synchronicity and generalization of seizure activity over time. These findings lead me to hypothesize that viral-induced seizures result in maladaptive myelination which may contribute to the progression of epilepsy. The TMEV mouse model of viral-induced epileptogenesis is used as a preclinical model of seizures and epilepsy. Previous work shows that glial cells, such as microglia and OPCs, become reactive and proliferate at the primary injury site of the hippocampus following infection. Preliminary data from mice at 6 days post-infection suggests that there may be increased myelination in the hippocampus after TMEV infection, particularly in the CA3 region. To assess whether OPCs contribute to myelination following viral infection, I use immunohistochemistry for the myelin-specific protein (MBP) to compare the amount of myelin between TMEV-infected mice and saline-injected controls throughout a time course following TMEV infection. The results of this study will contribute to our understanding of activity-dependent myelination in the brain following viral encephalitis and seizures and may identify a novel target for preventing or treating the development of epilepsy following viral infection.

### Poster 32

**Presenter: Joseph Furniss** (Utah State University)

Mentor: Laura Moreno (Family & Preventative Medicine)

*"Barriers for accessing prenatal care in three underserved populations in Salt Lake City: Former Refugees, Hispanics and Native Americans"*

Former Refugees, Hispanics and Native Americans are the largest minority groups in the state of Utah. Alarming, research has shown that compared to American born-white women, minority women in the US consistently suffer more from complications risking both themselves and their babies during pregnancy (Abuelezam et al., 2020), (Korinek & Smith, 2011), (Reichman & Kenney, 1998), (Reddy et al., 2021), (Long & Curry, 1998), (Warne & Lajimodiere, 2015). Furthermore, Flores et al. (2012) and Korniek & Smith (2011), found that unique state policies and community composition can change the experiences and health outcomes of these communities. Owing to these results, we are conducting a study in Salt Lake, trying to understand the unique barriers Former Refugees, Hispanics and Native Americans face that prevent them from receiving adequate prenatal care. We believe each group may encounter different challenges unique to their community. We will analyze data focusing on number of prenatal visits, late to care diagnosis and maternal complications followed by conducting semi structured interviews from a sample of these three groups and compare them to American born-white women. It is our intent that this information will direct future research to further investigate barriers to prenatal care and better support the women from these three communities over their perinatal experience.

### Poster 33

**Presenter: Rodrigo Gallegos** (University of Utah)

Mentor: Saveez Saffarian (Physics & Astronomy)

*VLP Probing into Gentler Harvest Techniques for higher intact VLP Concentration*

This study investigated harvesting SARS-Cov 2 and HIV VLPs in a gentler manner compared to previous harvesting techniques. From previous testing, we knew that PEG harvests have a tendency to provide more intact VLPs at the cost of a decreased overall yield of VLP constituent proteins, a tradeoff that we gladly accepted. However, at the start of the study there were many unknowns regarding the effectiveness of certain differences in the harvesting procedure, most notably in the duration of centrifuge spins and in the further purification of VLPs in PBS using either dialysis or Amicon filtering. Over the course of this project, we tested different times for centrifuging VLPs in PEG solution, from 30 minutes to 3 hours. The general trend for HIV VLPs showed that HIV VLPs had higher yields with longer spin times, as seen from both protein stains and cryo-electron microscopy. Notably, the study also found that SARS VLP yields were suitable even with only half an hour of centrifuging, though marginal utility for 1 hour centrifuging was found. As to post PEG harvest processing, we found that sucrose gradients were very well suited to giving a clear idea of the general effectiveness of the initial PEG harvest. Sucrose gradients also allowed an initial VLP sample to be divided into a specific series of subsamples of higher and lower VLP concentration, allowing us to select for higher yield VLP samples. Using protein stains to check relative protein concentration of differing subsamples of an initial VLP sample, we were thus able to find the highest yield subsamples of VLPs, giving us better imaging for cryo-EM and higher concentrations of VLPs for downstream applications. Notably, after a sucrose gradient, the VLPs are suspended in sucrose, which is removed with either Amicon filtering or dialysis, with marginal differences in effectiveness between each process (though the amount of labwork spent on dialysis compared to Amicons has led to favoring Amicon filtering).

### Poster 34

**Presenter: Natalia Garrido** (University of Utah)

Mentor: Claudia Geist (Gender Studies)

*The more you know: Knowledge about gender as basis to inclusive health care practices*

Research has documented the many barriers to accessing health care and receiving quality, affirming care for gender and sexual minority individuals. To shed light on possible solutions to providing more inclusive health care environments, we focus on attitudes and practices among future healthcare professionals, the essential first impressions for sexual and gender diverse (SGD) patients. Pre-health students express mostly positive attitudes toward SGD individuals, but studies show throughout the health fields there seem to be a range of poor to no training or education measures on SGD health within school curriculums and occupations. Failure to understand and empathize with these complex differences and interconnections of SGD identities and health have left the SGD community drowning in life-threatening

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and chronic health conditions. This study focuses on attitudes, views, and knowledge, via survey, of pre-health undergraduate students (who have completed a specific amount of patient-centered hours) toward sexuality and gender. We found mostly positive and supportive attitudes toward SGD individuals. 88% of students noted that hospitals should be a place to safely express and explore gender identities. With abstract topics of gender and sexuality, most acknowledged the differences and binaries of gender and sex, but there was a constant undecided response (neither agree nor disagree) throughout majority of the abstract questions. We found that 74% altogether disagree with no difference between sex and gender and 7% altogether agree while 19% neither agree nor disagree. The more gender and sexual diverse a student identified, the more likely they noted they understood the complexities of sex and gender. This data further emphasizes that the attitudes of future healthcare providers are not the only foundations of exclusions in the healthcare system, but rather a healthcare system and biased curriculum issue. It also further stresses the need to make room for SGD leadership in the reformation of the healthcare system.

### Poster 35

**Presenter: Audrey Glende** (University of Utah)

Mentor: Shanti Deemyad (Physics & Astronomy)

*High Pressure Studies on Colossal Magneto-resistant Material  $\text{EuCd}_2\text{P}_2$*

Magnetism and superconductivity are quantum phenomena that are observed in many materials yet only understood to a limited degree. Both properties are of extreme technological importance and are closely related to each other. One of the most elusive yet critical characteristics of matter that remains outside the grasp of the scientific world is that of superconductivity at ambient conditions; a quality that would allow for infinite electrical conductivity and nearly zero-energy magnetic levitation due to its ability to expel magnetic fields perfectly, superconductivity (if feasibly achieved) would revolutionize technology and infrastructure alike.

Alternatively, a group of materials - those that display Colossal Magneto-resistance (CMR) - experience a dramatic change in their electrical resistance in response to the presence of a magnetic field. High pressure studies allow for a better understanding of both of these fascinating states of matter; moreover, magnetism and superconductivity frequently compete with each other in materials - here, pressure can be used as a tuning parameter between the two states.

We've pursued studying the pressure effects on electrical properties of a material called  $\text{EuCd}_2\text{P}_2$  which displays CMR as an as-grown crystal despite possessing none of the usual certain properties of extremely magneto-resistant materials. Previously, expounding upon the work of the Tafti group at Boston College, our lab performed preliminary experiments on the crystal structure of  $\text{EuCd}_2\text{P}_2$  under pressure. After refining and preparing improved systems we completed a series of conductivity measurements on the sample under varying extreme pressures. We are now mapping the electronic properties of this material under pressure to obtain a full picture of the mechanism of CMR and its dependence on density in this compound.

### Poster 36

**Presenter: Naomi Guerrero Reyes** (Westminster College)

Mentor: Erin McGlade (Psychiatry)

*Acculturative Stress and Suicidal Behavior Among Hispanics in the U.S.*

Suicidal behaviors (e.g., suicidal ideation and attempts) among Hispanics in the US have been increasing since the 2000s (Silva & Van Orden, 2017). Two factors that are causing an increase in suicidal behaviors is acculturation and acculturative stress. The term acculturative stress has been defined as the psychological impact of adaptation to a new culture (Smart & Smart, 1995). Acculturation is defined as the process of adapting to a new culture (Mody, 2007). Discrimination, poor language comprehension, low socioeconomic status, family conflict, and low levels of support are some of the acculturative stressors that contribute to suicidal behaviors (Haboush-Deloye et al., 2015). The purpose of this review is to summarize the studies examining suicidal behaviors associated with acculturation and acculturative stress among Hispanics. Many of the studies in this review have found significant relations between suicidal behavior and acculturative stress. However, additional research and public health interventions are needed to better understand and address why acculturative stressors are affecting the mental health of the Hispanic community in the US. One major study that can provide insight to this association is the nationwide Adolescent Brain Cognitive Development (ABCD) study (including the Diagnostic Neuroimaging, University of Utah site), which is a 10-year longitudinal study that includes variables on suicide behavior and acculturation in youth. Future directions for research and interventions on acculturative stress and suicide behaviors also will be explored.

*Keywords:* acculturation, acculturative stress, suicide, suicide ideation, suicidality, suicide behavior, suicide attempt, Hispanic, Latino, Latina, Mexican, Central American, South American.

### Poster 37

**Presenter: Mattias Gunnarsson** (Brigham Young University)

Mentor: Sungjin Park (Neurobiology & Anatomy)

*Developing an In Vitro System for ECM Assembly*

The tectorial membrane of the inner ear has a unique and intricate extracellular matrix comprised of radially oriented parallel collagen fibrils. Elongating collagen fibrils attach to the tip membrane of microvilli of supporting cells, which is required for collagen organization. However, how collagens are recruited to a specific membrane compartment is unknown. We hypothesize that TECTA, a collagen binding

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protein, is specifically localized to the tip membrane of the microvilli and is removed from the base and lateral membrane by TMPRSS2 sheddase. To test this, we worked to develop an in vitro system using cell cultures transfected with myosin, which induces filopodia, a microvilli-like structure in cultured cells. We observed that expression of myosins induced filopodia formation in HeLa and COS-7 cells. Myo1b induces more filopodia than Myo10. Using this in vitro system we established, we will test whether TMPRSS2 is specifically removes TECTA from the base and lateral membrane of filopodia and thus preserve TECTA on the tip surface membrane. Overall, the in vitro system will be a useful tool to understand the mechanism for membrane compartmentalization and its role in extracellular matrix assembly.

### Poster 38

**Presenter: Ranger Gunville** (University of Nebraska Lincoln)

Mentor: Guillaume Hoareau (Surgery)

*Comparison of Resuscitation Products for Canine Hemorrhagic Shock*

Hemorrhagic shock is a significant cause of morbidity and mortality in severely traumatized patients, with an estimated 1.5 million cases occurring each year. Current resuscitation paradigms rely on blood products that require refrigeration or freezing. While this is easily implemented in urban areas, this proves more challenging in underserved areas or combat zones. We are testing novel resuscitation strategies that use shelf stable products: freeze-dried plasma (FDP) + hemoglobin based oxygen carrier (HBOC) + lyophilized platelets (LP). We will compare those strategies to the use of lactated ringer solution (LRS) + hetastarch (HEs), fresh frozen plasma (FFP) + packed red blood cells (pRBC), and chilled whole blood (CWB), freeze-dried plasma (FDP) + hemoglobin based oxygen carrier (HBOC). We hypothesize that a combination of shelf-stable HBOC, FDP and LP will be non-inferior to canine CWB to resuscitate in hemorrhagic shock. Seven dogs underwent general anesthesia and 40% of the blood volume was removed (T0) over 1 hour to induce hemorrhagic shock, then left untreated for 45 minutes. Animals were randomized to receive LRS+HEs or FFP+pRBC or CWB or FDP+HBOC or FDP+HBOC+LP. Citrated blood was collected at T0, T105, T135, T180 as well as 24 hours and 2 weeks after each experiment. Coagulation parameters were assessed using thromboelastography. Overall, TEG data (R, k, alpha, maximal amplitude) showed no significant differences between the shelf-stable and non shelf-stable strategies. Our data showed that FDP + HBOC + LP is a reasonable alternative to conventional resuscitation strategies. The findings are vital and relevant to combat zones.

### Poster 39

**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). 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 variables that we call "spectra". Spectra variables can be used in predictive modeling to identify high-risk groups.

Transcriptome data from 768 patients in the international CoMMpass study was used to derive 39 MM spectra to describe MM tumors. Each patient has their unique set of spectra values (spectra "barcode"). Similarities and differences in patients can be visualized with the barcode. Predictive modeling using spectra identified risk groups for survival and time to treatment failure. In this way, a patient's tumor transcriptome can predict whether they are at high-risk to die sooner, or their treatment fail earlier.

To replicate our CoMMpass findings, we are collecting and processing 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 and the spectra is calculated. Blood or saliva is used to extract normal DNA.

The SPECTRA technique provides a more complete understanding of MM by better characterizing tumors. Each spectra is a different tumor characteristic. Our future research includes investigation of whether inherited variations (in normal DNA) are associated with particular spectra, and other characteristics of MM toward early detection and prevention efforts. We are also pursuing the SPECTRA technique in several other cancers.

### Poster 40

**Presenter: Tala Hammond** (University of Utah)

Mentor: Sihem Boudina (Biochemistry)

*The Role of Liver-Specific autophagy in Hepatic Homeostasis in the marine liver.*

Liver disease accounts for approximately 2 million deaths per year worldwide. Liver disease is a global health crisis mainly caused by insulin resistance and hepatomegaly (liver enlargement). Autophagy is important because it plays a key role in the homeostasis of the cell by getting

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rid of toxins along with unnecessary or dysfunctional components. It is important to understand it on a deeper level because defects related to autophagy are linked to a variety of diseases. The better it can be understood, the more likely it can be used as a potential treatment for related diseases such as diabetes and hepatomegaly. During fasting, the autophagy pathway is activated in response to starvation. However, its role in the liver is not well known. The question arises: Does loss of liver-specific autophagy result in hepatic dysfunction? To better understand it, our lab generated Atg3 (an autophagy activator) knockout mice to see if impairment of autophagy leads to hepatic dysfunction. A cohort of liver-specific Atg3 knockout mice was generated by breeding mice harboring loxP sites on the exons of the Atg3 gene. These floxed mice were then bred with mice carrying the Alb-cre promoter that specifically deletes the Atg3 gene in mice hepatocytes. A control group of mice with normal Atg3 function was also used to compare phenotype differences. Glucose homeostasis via Glucose Tolerance Test (GTT) and Insulin Tolerance Test (ITT), protein isolation, and histology staining to assess fibrosis, hepatocyte size and glycogen content were performed to analyze hepatic dysfunction. We found that loss of Atg3 impaired autophagy, glucose homeostasis and caused hepatomegaly. Our lab hypothesizes that the loss of Atg3 impairs glucagon signaling in the liver during starvation periods leading to glycogen accumulation. Therefore, fasting periods can possibly be detrimental as glycogen in the liver is unable to be released which ultimately results in hepatomegaly. Further research is being conducted to shed light on this area of interest to further understand autophagy's critical role in hepatic

### Poster 41

**Presenter: Caden Hamrick** (Mercer University)

Mentor: Jacob George (Electrical and Computer Engineering)

*Using Arm Movements to Control Smart Home Devices*

The purpose of this research is to develop an algorithm following a joint classification-regression scheme to provide consistent, accurate and proportional myoelectric control of smart home devices. Myoelectric control has seen use in a wide array of applications but has been particularly popular in the development of prosthetics, orthotics, and other assistive devices. Recent advancements in myoelectric control stem largely from an improvement in signal processing techniques, as well as the advent of deep learning's application in this space. Deep algorithms typically approach myoelectric control using either classification or regression. Classification schemes used in upper body myoelectric control classify gestures made by the user as discrete output, whereas regression schemes estimate a continuous output --often but not necessarily-- kinematics. In this application, we use a joint classification-regression scheme to perform gesture recognition and proportional control. We employ a Convolutional Neural Network (CNN) to classify input EMG signal as one of three gestures: wrist supination/pronation, wrist flexion/extension, and do nothing. In addition to the CNN, there are also two Kalman Filters (KF) trained for regression on separate classes: one trained to estimate supination/pronation, the other flexion/extension. The CNN determines which KF is relevant, while allowing the other to be ignored. Offline testing has shown that they CNN yields ~97%. Further research will investigate how to overcome the donning/doffing problem and improve the system's real-time accuracy.

### Poster 42

**Presenter: Youssef Harraq** (Utah Tech University)

Mentor: Henry Kopecek (Pharmaceutics & Pharmaceutical Chemistry)

*Obinutuzumab-Based Drug-Free Macromolecular Therapeutics Synergizes with DNA Synthesis Inhibitors*

Drug-Free Macromolecular Therapeutics (DFMT) is a novel therapeutic that induces apoptosis upon crosslinking of receptors on the cell surface without the use of chemotherapies. The system consists of an antibody Fab' fragment linked to a morpholino oligonucleotide (Fab'-MORF1) and a complementary oligomer strand, MORF2, multivalently conjugated to human serum albumin (HSA-(MORF2)<sub>10</sub>). Upon hybridization of the two nanoconjugates, the cross-linking of CD20 receptors leads to a series of apoptotic cell mechanisms causing cell death. The antibody used to target CD20 receptors was Obinutuzimab (OBN). Herein, we investigated the combination of OBN DFMT with various chemotherapies using Chou-Talalay mathematical theory. IC<sub>50</sub> concentrations of eight chemotherapies were identified on a CD20 positive Non-Hodgkin's Lymphoma cell line (Raji) using a CCK-8 assay. The IC<sub>50</sub> concentrations were used to perform combination efficacy experiments with OBN DFMT using Annexin V and Propidium Iodine stains and analyzed with flow cytometry. We discovered common proliferation inhibitor drugs such as ibrutinib and idelalisib showed an antagonistic effect suggesting that crosslinking of CD20 lead to activation induced cell death in malignant B-cells. Chemotherapies that interfered with DNA synthesis like etoposide, gemcitabine, and doxorubicin provided synergistic effects with OBN DFMT as determined from combination index calculations (CI<1). We investigated cellular apoptotic mechanisms of action including cell cycle arrest, lysosomal enlargement, NF- $\kappa$ -B expression, mitochondrial depolarization, m-TOR and PI3K inhibition, caspase 3 activation, BTK pathway activation, and reactive oxygen species generation to obtain a deeper understanding of the mechanism of action of the OBN DFMT system in combination with various chemotherapies.

### Poster 43

**Presenter: Tyler Haskell** (Utah State University)

Mentor: Mitchell Garets (Internal Medicine)

*Rural Addiction Implementation Network (RAIN) Initiative: A Broad Healthcare Response to Opioid Use Disorder in Rural Communities through External Facilitation*

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Introduction: Prescription opioid related deaths more than quadrupled from 1999-2016, disproportionately affecting rural communities where overdose rates and rates of opioid use disorder (OUD) diagnoses are higher than urban environments. This necessitates a broad-based health system response that extends beyond the urban-based specialty care into rural areas.

Objective: To implement addiction evidence-based practice core activities into four rural hospitals/health-systems. To educate and provide skills of 1) evidence-based addiction prevention, treatment, and recovery and 2) implementation processes to RAIN Teams within the four hospitals/health-systems.

Methods: Four hospitals/hospital-systems of the University of Utah Regional Health Network were chosen and "RAIN teams" were established at each site. Each RAIN team chose one core activity that focused on either the prevention, treatment, or recovery of OUD. External facilitation was utilized to educate, motivate, and assist RAIN teams in implementation.

Results: St. Peter's Hospital was able to identify and meet with stakeholders to increase community engagement. St. John's and The Utah Navajo Health System created culturally focused educational brochures on naloxone and substance use disorder (SUD) that was distributed to patients and other community members. Madison Memorial Hospital meet with law enforcement and incorporated an educational program into schools on "Life skills," including drug use disorders. Barriers to implementation were identified, most notably that RAIN Teams have competing demands that slowed implementation progress. Monthly facilitator meetings and site visits effectively identified barriers to implementation and progressed core activities.

Conclusion: By utilizing external facilitation across a broad-based health system, it can be expanded to include more hospitals/hospital-systems that can follow a similar method to implement necessary addiction prevention, treatment, and recovery evidence-based practices to combat the US opioid crisis.

### Poster 44

**Presenter:** Sarah Haysley (Ohio State University)

Mentor: Skyler Jennings (Communication Sciences and Disorders)

*Assessment of an Auditory Reflex that Facilitates Listening in Background Noise*

Hearing in background noise is a significant listening challenge for individuals with hearing loss (HL). Based on animal research, the medial olivocochlear reflex (MOCR) is hypothesized to improve listening in noisy backgrounds. This improvement may be diminished with HL. Clinical assessment of the MOCR is essential to understand the extent to which a patient's speech-in-noise difficulties may be explained by MOCR dysfunction. Yet, current assessments of the MOCR require individuals to have good hearing sensitivity. The purpose of this study is to develop an alternative assessment of MOCR function based on the cochlear microphonic (CM), which produces reliable responses in individuals with HL. When the MOCR is elicited by contralateral sound, the CM amplitude increases. As a first step toward developing a clinical test of the MOCR, this study was designed to determine which frequencies result in the largest MOCR-induced increase in CM amplitude.

The effect of contralateral noise on the CM was measured from an electrode placed on the tympanic membrane. Contralateral broadband noise was presented to the left ear to elicit the MOCR while an ipsilateral test tone (probe) swept from 100 - 6000 Hz in the right ear. Six normal hearing young adults completed two conditions: a downward and an upward sweeping probe.

The results show that the CM amplitude increased in the presence of contralateral noise, consistent with eliciting the MOCR. This enhancement was greatest for frequencies between 250 and 2000 Hz suggesting that future clinical tests based on the CM should focus on this frequency region. This study's design shows promise for assessing the MOCR in individuals with HL. The next step is to extend this design to include older adults with normal hearing and HL to test the hypothesis that a CM-based test is sensitive to the putative declines in MOCR function that result from HL.

### Poster 45

**Presenter:** Jose Hernandez ()

Mentor: Aaron Leifer (Biochemistry)

*Investigating LDHA inhibition by palmitoyl-CoA*

The dysregulation of metabolism leads to diseases such as cancer. The most famous connection between cancer and the dysregulation of metabolism is "The Warburg Effect". The Warburg effect is the term used to describe the cancer cells voluntary use of anaerobic glycolysis, providing it with building blocks required for cell replication. A major enzyme in anaerobic glycolysis is Lactate Dehydrogenase (LDH). LDH conducts the reversible reaction of pyruvate to lactate and NADH to NAD<sup>+</sup>. In cancer cells high levels of LDH allows the continuation of glycolysis through the regeneration of NAD<sup>+</sup>. LDH has two isoenzymes, LDHA and LDHB. The isoenzymes have 75% identical amino acid sequence identity. The enzymes were run on the MIDAS platform, a metabolite-protein screening platform developed by the Rutter Lab. When run through the platform it was shown that the long chain acyl-CoAs bound LDHA. This study was followed up through activity assays which showed that long chain acyl-CoAs (palmitoyl-CoA) inhibited LDHA but not LDHB. The goal of this project was to create a mutant form of LDHA that has the same kinetic properties but is no longer inhibited by palmitoyl-CoA. This will allow the lab to investigate the interaction between palmitoyl-CoA and LDHA in cells and in mice. We are looking to develop a chimera consisting of both isoenzymes that does not allow palmitoyl-CoA to inhibit it. Due to the high sequence similarity we were able to design a series of chimeras. These chimeras consist of varying ratios of each isoenzyme. This will allow us to narrow down the region that is responsible for



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palmitoyl-CoA sensitivity. We hypothesize that through the creation of the chimeras we will be able to narrow down the region responsible for palmitoyl-CoA sensitivity.

### Poster 46

**Presenter: Nathan Hill** (Brigham Young University)

Mentor: J. David Symons (School of Biological Sciences)

*Vascular function of the components of a murine Arteriovenous Fistula model*

Introduction: Few studies have characterized vasoreactivity of the murine external jugular vein. This segment often is used in preclinical models to evaluate vascular remodeling in response to arteriovenous fistula (AVF) maturation. When an AVF is established, the venous segment is exposed to arterial pressures and disturbed flow patterns that have strong potential to impact vasoreactivity.

Objective: To characterize vascular function of the components of the arteriovenous fistula in murine models, namely the external jugular vein (EJV) and the carotid artery (CA). We hypothesize that the EJV involved in the AVF procedure will display endothelial dysfunction compared to a control EJV. We also hypothesize that the distal portion of the CA involved in the procedure will experience diminished endothelial function.

Methods: Vasomotor responses of external jugular veins and common carotid arteries from C57BL/6 mice were evaluated using isometric tension procedures. Dose responses were collected after exposing the vessels to U46619 (vasocontraction), Acetylcholine (endothelium-dependent vasorelaxation), and Sodium Nitroprusside (endothelium-independent vasorelaxation).

Results: The EJV involved in the AVF procedure (EJV-AVF) experienced diminished function to U46619 compared to the control EJV. Therefore, vasorelaxation using ACh and SNP could not be measured. The distal portion of the artery involved in the procedure (DA-AVF) experienced diminished reaction to U46619, but experienced greater vasorelaxation to ACh when compared to the proximal portion of the same artery and the control artery.

Conclusion: Because vasorelaxation in the vessel could not be measured, further testing is required to confirm that the EJV-AVF displays diminished endothelial function. However, because it showed diminished reaction to U46619, it is likely that the vessel is affected by the surgery. Contrary to our hypothesis, the DA-AVF displayed greater vasorelaxation when exposed to ACh. It is possible that other relaxation factors are compensating for decreased endothelial function.

### Poster 47

**Presenter: CJ Hirschi** (Brigham Young University)

Mentor: Ashutosh Tiwari (Materials Science and Engineering)

*Synthesis of Transparent Conducting Oxide Thin Films*

Transparent conducting oxide thin films have many important applications, including touchscreens, solar cells, batteries, etc. Because these thin films are in increasingly high demand, it is important to develop new techniques for synthesizing them and new materials that can be made into transparent conducting thin films. This study uses a simple method of forming an oxide pellet using solid-state synthesis, and then using this pellet as a target in pulsed-laser deposition to deposit a transparent thin film on a substrate. We explore BaSnO<sub>3</sub>, LaSnO<sub>3</sub>, and CaSnO<sub>3</sub> as potential transparent conducting oxide materials

### Poster 48

**Presenter: Jude Horsley** (University of Utah)

Mentor: Zlatan Aksamija (Materials Science and Engineering)

*Improving Thermoelectrics Through Dielectric Enhancement*

A thermoelectric device is a device capable of generating an electromotive force when opposite ends of an electrically conducting material are exposed to a temperature gradient. This process is called the Seebeck effect. Because of their unique ability to harness temperature differences for electrical power, thermoelectrics have immense potential to produce clean energy. While we have yet to discover thermoelectric materials that are efficient enough to replace current engines at large, they can greatly enhance the efficiency of power plants and car batteries by capturing and harnessing the waste heat they produce.

Thermoelectric performance in a material depends on the transport properties of the material. Electrical conductivity is proportional to  $\sigma T$ , the unitless thermoelectric figure of merit. As such, thermoelectric materials are often doped with charge carriers to increase conductivity. However, dopants also scatter electrons in transit, so doping a material too heavily will hinder its conductivity, and by proxy its thermoelectric performance. Much of the recent work in thermoelectrics seeks to find the optimal doping percentage for different thermoelectrics.

This work tests a new method for improving thermoelectric performance by enhancing the transport of well-known thermoelectric materials. We believe that adding a small amount of a material with a high dielectric constant to a thermoelectric will increase the overall dielectric constant of the resulting material. This will screen out the impurity scattering that results from dopants in the material, enhancing electronic transport and, as a result, thermoelectric performance.

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We choose to enhance magnesium silicide in this way by adding barium titanate. We computed the band structure for Mg<sub>2</sub>Si using density functional theory and simulated the transport properties of our Mg<sub>2</sub>Si-BaTiO<sub>3</sub> mixture using Rode's method based on Boltzmann Transport Theory (Rode, 1975). We then synthesized this material to test the accuracy of our simulations.

### Poster 49

**Presenter: Nishoni Huber** (Northern Arizona University)

Mentor: Stavros Drakos (Bioengineering)

*Understanding adipocyte enhancer binding protein 1 (AEBP1) inhibition in reducing fibrosis*

Heart failure patients are often diagnosed with multi-organ failure and multi-organ fibrosis. There is a notable role of adipocyte enhancer binding protein 1 (AEBP1) in fibroblast differentiation and extracellular matrix deposition. Previous research has shown an increase of AEBP1 in liver, lungs, and white adipose tissue fibrosis and AEBP1 knockdown (KD) resulted in a reduction in active fibrosis in these organs. The role of AEBP1 in cardiac and skeletal muscle fibrosis needs further understanding. Our current research will establish the role of AEBP1 in these organs, thereby making AEBP1 a potential therapeutic target for multi-organ fibrosis. Our preliminary data shows that AEBP1 overexpression independently drives cardiac fibroblast activation, evident from an increase in SM22, early fibroblast differentiation marker (n=6, p=0.06) and AEBP1-KD resulted in a significant reduction in SM22 (n=6, p=0.03). Angiotensin (1.5µg/g/day) and phenylephrine (50µg/g/day) were injected in mice for 4-weeks to induce multi-organ fibrosis (established fibrosis model). A subset of mice received adeno-associated virus 9 (AAV9) containing shRNA that results in AEBP1-KD, remaining mice received control virus. In vitro studies on mice heart showed a reduction in SM22 (n=6, p=0.07) upon AEBP1-KD. A significant reduction in SMA, marker of activated fibroblasts, was also observed in skeletal muscle (n=6, p=0.001) upon AEBP1-KD. Overall, our results suggest a unique role of AEBP1 in cardiac and skeletal muscle fibrosis. A greater understanding of AEBP1-mediated fibrotic pathways can lead to using AEBP1 as a potential target for multi-organ fibrosis.

### Poster 50

**Presenter: Reese Hunsaker** (Brigham Young University)

Mentor: Joe Visker (Internal Medicine)

*Cell Signaling Modifications in Response to Myocardial Infarction in Cardiac Myocytes*

Acute myocardial infarction (AMI) is the leading cause of death. Therapies for AMI can damage cardiomyocytes when oxygen is restored leading to reperfusion injury (RI). During ischemia, cardiomyocytes rely upon glycolysis and cellular communication for survival. We have observed that mitochondrial pyruvate carrier-1 deficient mice (MPC1-KO) have less myocardial salvage following RI. Therefore, we analyzed markers of inter-cellular communication (Notch3 & Jag1) in MPC1-KO mice after RI. We hypothesized that MPC1-KO mice will also have reduced NOTCH3 and JAG1 indicative of impaired inter-cellular communication which may explain the reduced myocardial salvage following RI. Using the cre-lox recombinase system, MPC1-KO mice were generated using a cardiac specific tamoxifen inducible deletion of MPC1. MPC1-KO mice were given IP injections at 8 weeks of age and then were used for RI 4 weeks later. Mice were subjected to LAD ligation for 30 minutes, then the ligature was removed, and hearts reperfused for 120 minutes (WT: n=5, KO: n=4). Following RI, ischemic and non-ischemic tissue was biopsied. Then, to characterize genetic and proteomic alterations to inter-cellular communication, we performed quantitative polymerase chain reaction (qPCR) and Western blotting in wildtype (WT) and MPC1-KO mice to assess NOTCH3 and JAG1 levels (au: arbitrary units). An  $\alpha$ -level of 0.05 was set a-priori and all statistics were analyzed using a two-way ANOVA with a Tukey's HSD post-hoc test using GraphPad Prism. In the tissue exposed to ischemia, NOTCH3 gene expression was significantly decreased in MPC1-KO mice (0.495  $\pm$  0.31 au) compared to WT (1.67  $\pm$  0.54 au). Additionally, JAG1 in MPC1-KO mice (0.446  $\pm$  0.48 au) was also decreased when compared to WT mice (1.33  $\pm$  0.38 au). On the protein level, NOTCH3 abundance was downregulated in ischemic tissue (0.747  $\pm$  0.066 au) when compared to non-ischemic tissue (1.61  $\pm$  0.38 au). In conclusion, cellular communication through Notch signaling is reduced in MPC1-KO mice following RI which may lead to more severe infarctions when glycolysis is inhibited.

### Poster 51

**Presenter: Sam Jurado** (Cornell University)

Mentor: John Horel (Atmospheric Sciences)

*Ozone Suppression: Analysis of Ozone Concentrations During High Temperature Conditions*

In 2022, the Wasatch Front and parts of the Uinta Basin were designated as Marginal nonattainment areas for ozone - a harmful air pollutant - by the Environmental Protection Agency. Temperature has been used as a predictor for ozone concentrations due to its influence on the kinetic rates of ozone generation. Ozone concentrations from 11 Utah Division of Air Quality and University of Utah reporting sites during summers from 2014 to 2021 are compared during days within three regimes: 1) daily maximum temperature > 95th percentile, 2) 8-h maximum ozone >70 ppbv, 3) remaining summer days.

Peak ozone concentrations are lower on days with extremely high air temperatures (>36°C) presumably due to both meteorological and chemical reaction factors. Under locally driven diurnal wind conditions, increases in ozone may be more affected by NO<sub>x</sub> concentrations as extreme temperatures may reduce the biogenic emissions of volatile organic compounds. Lower ozone peak values were also observed during record high temperature days due to strong synoptically-dominated surface winds and enhanced vertical mixing. These results

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highlight that the assumption of high ozone concentrations will occur on days with high temperatures may not be valid and that more atmospheric observations of NO<sub>x</sub> and VOC emissions are needed in the Salt Lake Valley.

### Poster 52

**Presenter: Bobby Kaman** (Iowa State University)

Mentor: Huiwen Ji (Materials Science and Engineering)

*Synthesis of Fe(x)NbS<sub>2</sub>*

Transition metal dichalcogenides (MX<sub>2</sub>) are 2D layered Van der Waals crystals that are usually electronically conductive. The intercalation of these compounds with magnetic ions can lead to diverse and tunable electronic and magnetic properties, and the coupling of the two. Fe(x)NbS<sub>2</sub> is an example of this, displaying a few antiferromagnetic phases at low temperature. The low symmetry of the x=1/3 phase allows the antiferromagnetic domains to be switched using a tiny electrical current, rotating its resistivity tensor and allowing the material to be used as an efficient binary switch. Also present (for non-stoichiometric compositions) but difficult to distinguish is a spin glass phase, in which no long-range order is present. Recent studies have reported that the spin glass phase is beneficial to this switching mechanism. The goal of this project was to synthesize single crystals of Fe(x)NbS<sub>2</sub> around x~1/3 and begin characterization.

A few (x) were produced and placed in iodine-filled quartz ampoules under a thermal gradient to facilitate iodine transport and crystal growth. Crystals up to ~1mm were grown, but none were large enough for traditional property measurements. Compositions were found to change during crystal growth. Thoughts are given to exploratory characterization techniques that may be necessary to distinguish between magnetic phases and domains, which have rarely been spatially resolved.

### Poster 53

**Presenter: Thomas Kauffman** (University of Utah)

Mentor: Jason Wiese (School of Computing)

*Making Smart Hospitals Useful*

Smart hospitals are arriving, driven by the vision to enhance the patient experience, reduce operational burden, and improve hospital workflow. The University of Utah's newly constructed Craig H. Neilsen Rehabilitation Hospital contains patient rooms where the lights, blinds, thermostat, TV, and wireless soundbar are all controlled through an app on a hospital furnished iPad or personal device. This novel implementation supports varying control abilities through touch, voice command, sip and puff controller, or physical switches and remotes. This technology is potentially transformative for patients experiencing motor or mobility impairments, helping them regain lost freedom and control of their surroundings. We explore how the technology employed in patient rooms affects - and can better support - patients' and other stakeholders' needs and experiences, how the smart room technology fits in the context of a hospital setting, and how the patient's experience with the technology affects how they view their transition to home through semi-structured user study interviews. We identify a range of considerations that inform the way smart technology is integrated into hospital environments, including design decisions about the technology itself, but also adjustments to the way that hospital staff introduce and support the technology to patients. Through continuing work, we can guide future designers in seamlessly integrating technology into the hospital environment to reduce burdens on all stakeholders, support patient's unique physical abilities, and enhance independence for those who have lost it.

### Poster 54

**Presenter: Maggie Kerwin** (Carleton College)

Mentor: Wes Sundquist (Biochemistry)

*Investigating the Structural and Cellular Roles of Angiomotin Isoforms*

HIV-1 is a membrane enveloped virus that relies upon host cellular proteins of the ESCRT pathway to bud and escape from cells. Early-acting ESCRT factors, ESCRT-associated E3 ubiquitin ligases, and host adaptor proteins are recruited to sites of viral assembly and budding by "late assembly domains" found in viral structural proteins. Angiomotin (AMOT) acts as an adaptor between viral structural proteins and the host ubiquitin ligase NEDD4L, and is required for efficient viral escape. The exact role of AMOT, however, remains unclear. In the absence of AMOT, assembling HIV-1 Gag molecules are unable to form fully spherical enveloped particles and HIV-1 release is inhibited, whereas the overexpression of AMOT significantly stimulates HIV-1 release. There are four different isoforms of the AMOT protein: AMOT p80 (a truncated form of AMOT), AMOTL1 (Angiomotin-like protein 1), AMOTL2 (Angiomotin-like protein 2) and AMOTL2 p60 (a truncated form of AMOTL2). AMOTL1 and AMOTL2 have also been identified as direct binding partners of both NEDD4L and HIV-1 Gag. In this study, we generated constructs of the AMOT p80, AMOTL1, AMOTL2 and AMOTL2 p60 isoforms and expressed these in 293T and HeLa cells.

### Poster 55

**Presenter: John Kim** (Arizona State University)

Mentor: Chen Wang (Materials Science and Engineering)

*Reaction Kinetics of Low-Input Energy Polymer Degradation*

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Have you ever ordered an iced coffee, bubble tea or smoothie at your favorite cold drink vendor? There is a good chance the plastic cup your beverage is served in is a plastic called Poly Lactic Acid. Most agree that PLA is biodegradable but only under certain conditions. Unfortunately, these conditions often are costly to process and chemically decompose. My research addresses this issue by using inexpensive reagents to dissolve PLA into solution without the addition extra thermal energy. The PLA degradation experiments in this presentation were done under room temperature and atmospheric pressure conditions, using common alcohol reagents and a cheap, available catalyst to speed the reaction. The purpose of this study is to log the reaction kinetics, characterize the final products and find the ideal alcohol solvent and amount of catalyst that creates a fast dissolution of PLA. In my findings, you will see that propargyl alcohol with a specific molar ratio of potassium carbonate is able to dissolve solid PLA in just a matter of hours. Additionally, the methods

### Poster 56

**Presenter: Luke Kim** (Kenyon College)

Mentor: Jose Gutiérrez (Education, Culture & Society)

*Domestic Sensibilities, Household Labor: Gender and Work in Indian Boarding School Mathematics Curriculum, 1879-1932*

In this presentation, we address the thread of cisheteropatriarchal structures in the mathematics curriculum from the Indian boarding school system during the administration of Estelle Reel. Specifically, we focus our analysis on how gender is always associated with housework and childcare in math word problems. We argue that these problems reflect how ideologies of gender oppression are a fundamental aspect and extension of settler colonial capitalism within the United States (Nakano Glenn, 2015). Theoretically, we draw upon prior Marxist feminist work that parse out the relationship between capitalism and patriarchy (Federici 1975; Vogel 1983; Mies 1986). Further, we directly connect these theoretical approaches in the analysis of the mathematical content to broader U.S. federal policy and reformist efforts (Stremlau, 2005) during our period of study, 1879-1932.

### Poster 57

**Presenter: Sharla Kirkpatrick** (North Carolina A&T State University)

Mentor: Mia Hashibe (Family & Preventative Medicine)

*Racial Differences in Depression Outcomes Among Older Rural vs Urban Breast Cancer Patients*

*Introduction:* Approximately 20% of the US population lives in a rural area yet only 3% of oncology specialists and 7% of non-oncology specialists practice in rural areas. This creates problems when breast cancer patients are trying to access care during treatment and beyond in remission. Advances in breast cancer treatment means that more women are surviving and for longer periods of time. However, mental health post cancer treatment is a concern. The purpose of this study is to examine the risk of mental health outcomes in older rural breast cancer patients by rural residence and by race and ethnicity.

*Methods:* A population-based cohort of breast cancer survivors was identified using linked data bases forming SEER-Medicare. The cohort is composed of individuals who are at least 66 years old, and identified as Medicare beneficiaries who were diagnosed with breast cancer between 2000 and 2018. There are 3 urban patients matched to each rural patient. Urban and rural patients are matched by diagnosis year (within range of +/-1 year), and diagnosis age (within range of +/-1 year).

*Results:* Almost 50% of all rural breast cancer patients have a lower SES and rural patients had higher rates of death than urban patients. There was no association between rural residency and an increased risk of depression. Non-Hispanic Asians and urban Non-Hispanic Asians had a decreased risk of depression for up to 10(+) years post breast cancer diagnosis, respectively (HR= .60, 95% CI= .45-.79; HR =.60, 95% CI= .45-.80). Additionally, rural Non-Hispanic Blacks have around a 30% decreased risk of depression 1 to 5 years after breast cancer diagnosis (HR= .68, 95% CI = .51-.89).

*Conclusion:* Despite the significant differences in care, rural breast cancer patients do not have an increased risk of depression. Due to cultural practices like religion, and close knit community, some minority groups exhibited decreased risks of depression. Non-Hispanic Asians, urban Non-Hispanic Asians and rural Non-Hispanic Blacks all have a decreased risk of depression.

### Poster 58

**Presenter: Pauline Kneller** (University of Utah)

Mentor: Gannet Hallar (Atmospheric Sciences)

*Cold Fog Amongst Complex Terrain: Experiences in a Collaborative Field Campaign*

While fog can negatively impact transportation, agriculture, and air quality, it still remains a poorly forecasted meteorological event due to lack of understanding in different aspects of its formation. The Cold Fog Amongst Complex Terrain campaign, a National Science Foundation funded field study headed by co-principle investigators Dr. Zhaoxia Pu from the U of U Department of Atmospheric Sciences and Dr. Eric Pardyjak from the U of U Department of Mechanical Engineering, uses a multi-disciplinary approach to improve understanding of microphysical, thermodynamic, meteorological, and aerosol properties of cold fog for the purpose of better understanding the mechanics of fog as well as refining numerical weather prediction and forecasting for cold fog events. Data collection and observations were taken in the field study portion of the project which ran from January 6 to February 23, 2022. This presentation

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reviews methods of data collection employed by different participating labs during the field study, with an emphasis on the work that I did in Dr. Gannet Hallar's lab.

### Poster 59

**Presenter: Raissa Kora Kodia-Batamio** (Howard University)

Mentor: Paul Sigala (Biochemistry)

*Understanding Hemozoin Crystal Movement in Malaria Parasites*

Malaria is a deadly disease caused by single-celled Plasmodium parasites. Malaria still lacks a broadly effective vaccine available and caused over half a million deaths in 2020 (WHO 2021). Plasmodium falciparum is the most common and virulent species of the parasite. Due to parasite complexity and growing drug resistance, this deadly disease remains a major threat within many global communities. A fundamental component of Plasmodium falciparum anatomy and survival during its infection of human red blood cells is hemoglobin digestion and the mitigation of cytotoxic heme released by this process. Hemozoin is a crystalline structure composed of heme that is produced in the parasite food vacuole as a mechanism to detoxify excess heme released during hemoglobin digestion. Hemozoin formation is essential for parasite health and a major drug target. After crystals form, they adopt a tumbling motion in the food vacuole whose origin is poorly understood. A lipocalin-like protein targeted to the parasite food vacuole has been shown to contribute to heme crystallization and motion, however, its properties and functional roles remain undefined. To better understand hemozoin motion and its cellular determinants, I am using fluorescent molecular dyes and live-cell microscopy to study the relationship between moving hemozoin and the properties of key organelles, including polarized mitochondria and a fully enclosed food vacuole. Also, using CRISPR-Cas9 technology to disrupt the lipocalin gene, I will study the relationship between the lipocalin protein and the movement of hemozoin in parasites. Studying this phenomenon will reveal fundamental understanding of a critical heme-detoxification mechanism of this parasite, can help identify new drug targets, and eventually, lead to a decrease in Malaria-related deaths.

### Poster 60

**Presenter: Peter Krauel** (University of Utah)

Mentor: Peter Armentrout (Chemistry)

*An analysis of gas-phase sulfide and oxide bonding of Uranium by Guided Ion Beam Tandem Mass Spectrometry (GIBMS)*

An important aspect of actinide chemistry is the elucidation of the nature of the interaction between the actinides and "hard" (O) versus "soft" (S) chalcogen atoms. Understanding these relationships, especially for uranium, can help to elucidate reactivities and chemical properties that can lead to more efficient and safer nuclear waste management programs. Here, U<sup>+</sup>, UO<sup>+</sup>, and US<sup>+</sup> were prepared in the gas phase, and their kinetic energy dependent cross sections were measured using guided ion beam tandem mass spectrometry. US<sup>+</sup> is formed through a barrierless exothermic process when the atomic metal cation reacts with CS<sub>2</sub>, with a reaction efficiency of  $74 \pm 15\%$  compared to the cross section predicted by the Langevin-Gioumousis-Stevenson model. Reactions with Xe and CO were studied, and endothermic reactions were modeled to yield 0 K bond dissociation energies (BDEs) of  $7.26 \pm 0.29$  eV (U<sup>+</sup>-O),  $5.75 \pm 0.13$  eV (U<sup>+</sup>-S),  $6.75 \pm 0.27$  eV (SU<sup>+</sup>-O), and  $5.25 \pm 0.37$  eV (OU<sup>+</sup>-S). These data are sufficient to characterize simple but important bonding differences between uranium and the two chalcogen atoms studied here.

### Poster 61

**Presenter: Jillian Landers** (Oklahoma State University)

Mentor: Katsu Funai (Physical Therapy and Athletic Training)

*Suppressing lipid peroxidation to slow frailty*

Lipid peroxidation has been indicated in functional defects associated with aging. Our previous study shows that a 2-week treatment with N-acetylcarnosine is effective in suppressing lipid peroxidation induced by a short-term physical inactivity in mice. N-acetylcarnosine is a dipeptide composed of acetylated  $\beta$ -alanine and histidine, and is an effective agent in neutralizing lipid peroxidation. The purpose of my project was to aid in the design and feasibility of a long-term (6 months) treatment of N-acetylcarnosine in 18 months old mice. We set out to systematically assess the effects of N-acetylcarnosine treatment on various organ systems. In designing our study, we reduced the number of strenuous tests to minimize the interference of these tests with aging and N-acetylcarnosine treatment. We decided to perform the following tests: 1) neuromuscular function with rotarod, wire hanging, treadmill running, and terminal muscle contractility test, 2) cognitive function with nest scoring and contextual fear conditioning test, 3) renal function with periodic urine collection, 4) metabolic function with indirect calorimetry and glucose tolerance test, and 5) cardiovascular function with echocardiography. We will also monitor changes in body weight and food and water consumption weekly. Results from our initial study will be used to identify organ systems that N-acetylcarnosine may be effective in improving function, and design subsequent more rigorous studies to examine specific organ systems.

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### Poster 62

**Presenter: Lee Larson** (University of Texas at Dallas)  
Mentor: Taylor Sparks (Materials Science and Engineering)  
*Using High-Entropy Oxides as the electrolyte of a Fuel Cell*

Using Sol-gel synthesis to make Cerium Oxide doped with the high entropy oxide GDHEO in different ratios. We ran characterizations like EIS, Density, XRD, and SEM.

### Poster 63

**Presenter: Mariah Lee** (Diné College)  
Mentor: Kristina Surosa-Johnson (Pediatrics)  
*Understanding Patient and Caregiver Knowledge of Condition in Differences of Sex Development*

Disorders/Differences of Sex Development (DSD) is an umbrella term describing congenital conditions where chromosomal, gonadal, or anatomic sex development is atypical. Now considered a foundation of patient-centered care, patient autonomy has not always been the norm, particularly in pediatric populations. Healthcare providers need to provide patients (and families in pediatric settings) with clear and relevant information about their condition and its management. Patient comprehension of their DSD is important for patients understanding how their body works and for decision-making regarding their care. Project aims are: (1) assess patient and caregiver understanding of the condition and (2) evaluate response consistency within families. As part of the DSD-Translational Research Network, a national biopsychosocial DSD registry, patients (n=81) and their caregivers (n=376) completed the Knowledge of Condition Self Report (KoC-SR) and Caregiver Report (KoC-CR) forms. These forms evaluate understanding of the DSD diagnosis. Majority of caregivers reported knowing the name of their child's medical condition (83%), but not knowing what caused the DSD (65%). Caregivers also indicated that 29% of patients were aware of their DSD. Forty-nine percent of patients reported knowing the name of their DSD diagnosis. The average age of patients finding out about their DSD was 13 years. Early and ongoing education is a central element of patient centered care. Clinically, the KoC-SR and KoC-CR allow providers to understand patient and caregiver knowledge and offer additional education and support.

### Poster 64

**Presenter: Silvia Lombardo** (Indiana University Bloomington)  
Mentor: Jim Steenburgh (Atmospheric Sciences)  
*Verification and Bias Correction of Global Forecast System (GFS) Precipitation Forecasts in Little Cottonwood Canyon*

There are over 50 avalanche paths that cross State Route 210 (SR-210) and pose a threat to highway traffic, buildings, and winter recreationists in Little Cottonwood Canyon (LCC) near Salt Lake City, Utah. To anticipate avalanche hazards along SR-210, accurate winter-storm forecasts are essential. Here we examine the accuracy of quantitative precipitation forecasts (QPF) produced by the Global Forecast System (GFS), one of the primary weather-forecast models used by the National Weather Service, relative to manual observations collected by the Alta Ski Patrol at their Alta-Collins snow-study plot. We show that the GFS under forecasts heavy cool-season (October to May) precipitation events, which may reflect the inability of the GFS to adequately resolve the complex terrain of the central Wasatch Range due to its coarse grid spacing (~13 km). To correct for this under-forecasting bias, we applied a downscaling QPF ratio based on higher resolution, monthly mean precipitation analyses for the central Wasatch, which improved forecasts. These results highlight the importance of downscaling coarse resolution computer model forecasts in mountainous regions where complex terrain plays a fundamental role in atmospheric processes and precipitation events.

### Poster 65

**Presenter: Trish Luu** (University of Utah)  
Mentor: Grace Hsu (Biochemistry)  
*Visualizing the Structure and Mechanism of DuoCAR T Cells Against HIV*

In the scientific community, visual communication is important in order to make complex science more accessible to non-expert audiences, especially in educational curriculum that is aimed toward patients. We are developing illustrations and an animation that will be used by researchers and clinicians to describe potential HIV therapies to HIV+ patients. Chimeric antigen receptor-modified T cell therapy, or anti-HIV CAR-T cells, is a type of immunotherapy that uses engineered T cells expressing anti-HIV CAR proteins on their surface. DuoCAR T cells express two anti-HIV CAR proteins-mD1.22 and m36.4-specifically designed to bind to the HIV envelope protein; the duoCAR structure protects T cells from HIV infection and redirects T cells to eliminate HIV-infected cells. As part of an educational curriculum, these illustrations and the animation will show the science behind duoCAR T cells and visually explain its function in protecting the patient.

### Poster 66

**Presenter: Julane Machado** (University of Utah)  
Mentor: James Gagnon (School of Biological Sciences)  
*Mapping gene expression changes in zebrafish embryos in response to ultraviolet radiation*

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Sunlight is critical to life on Earth, but ultraviolet rays (UV-B) can also cause damage to DNA. Some organisms have developed methods to mitigate this damage, such as the production of gadusol, a natural sunscreen-like compound generated by many fish. However, much of our current knowledge of UV responses in eukaryotes stems from cell culture experiments; we have a poor understanding of how organisms respond to UV exposure. My research aims to address this gap in understanding by employing zebrafish as a model organism. The purpose of my research is to identify changes to zebrafish embryo gene expression as a result of UV-B exposure, with and without gadusol. I collected RNA from zebrafish embryos 5- and 24-hours following brief UV-B exposure. I am using RNA sequencing at both timepoints to evaluate responses to UV exposure. At 5-hours post-exposure, I anticipate upregulated expression of DNA damage response (DDR) genes, as well as those involved in apoptotic pathways. Owing to rapid repair of damaged DNA, I expect that this upregulation in DDR expression will be less pronounced 24-hours post-exposure. I predict that the absence of gadusol will instead exacerbate apoptotic pathways due to irreparable DNA damage. My research aims to identify how organisms protect themselves and respond to sun damage, which is essential in light of a depleting ozone layer and increasing UV-B intensity.

### Poster 67

**Presenter: Rachael Mayhew** (Georgia State University)

Mentor: Regina Frey (Chemistry)

*Investigating social belonging in an undergraduate organic chemistry course.*

27% of students who earned an A and require general chemistry I and II for their major do not continue from the first half of the sequence to the second half of the sequence. Previously, this attrition in women had been predicted by their high early-semester belonging uncertainty. This construct falls under an umbrella term, social belonging, alongside the construct, sense of belonging. These two constructs have been examined in general chemistry, so the work presented here focuses on another gateway chemistry course into a STEM career, organic chemistry. This project seeks to answer the following questions in the context of an organic chemistry II course 1) What factors can predict sense of belonging or belonging uncertainty? 2) What impact does social belonging have on performance? To determine this an undergraduate organic chemistry II course in spring 2022 was surveyed using a series of adapted social belonging questions. This instrument was tested using structural equation modeling to establish validity and reliability. No significant difference in social belonging levels was seen across gender, first-generation status, race, or ACT Composite score. Early-semester performance is able to be predicted by initial sense of belonging and belonging uncertainty scores as well as gender and ACT Composite score. Late-semester performance is predicted by previous exam performance and ACT Composite score. As social belonging appears to lose relevance to students in this course, it is important to recognize that students who are not retained in earlier courses are often those impacted by their social belonging. In the future, interventions will be developed to target social belonging in introductory chemistry courses to support students.

### Poster 68

**Presenter: Victoria Medvedeva** (University of Utah)

Mentor: Aaron Puri (Chemistry)

*Secondary metabolite-assisted protection of an aerobic bacterium during anoxic stress*

All bacteria must overcome nutrient limitation in their environment; a consequence of natural variability and fluctuations within their specific niche. Despite the commonality of this challenge, the strategies bacteria use to survive nutrient limitation are understudied. This applies to methane-oxidizing bacteria (methanotrophs), which use methane as their only source of carbon and energy. Methanotrophs are obligate aerobes, meaning they require oxygen to survive. However, they must also survive periods of low oxygen to obtain methane created by anaerobic communities found deeper in sediments. Rising methane emissions are fueling the rapid warming of our planet, and it is critical that we identify ways to remove methane from our atmosphere. Methanotrophs are useful tools in bioremediation because they serve as methane sinks to sequester this potent greenhouse gas. We recently discovered that a methanotroph, *Methylobacter tundripaludum* strain 21/22 (21/22), produces a new secondary metabolite called tundrenone. This project investigates the role that tundrenone plays in the survival of 21/22 under anoxic stress. After subjecting cultures of 21/22 to periods of oxygen deprivation, we can assess the viability of the cultures. We found that wild type 21/22 has increased cell viability when compared with a mutant strain that does not produce tundrenone. We now hypothesize that tundrenone acts as an ionophore, depolarizing the cell's membrane during cellular respiration, and decreasing the need for oxygen to act as the final electron acceptor. Understanding the mechanism by which 21/22 survives low-oxygen conditions may enable optimization of this organism, and others, as methane-sinks and other useful environmental tools.

### Poster 69

**Presenter: Morgan Merriman** (Clemson University)

Mentor: Matthew Sigman (Chemistry)

*Computer-Assisted Natural Product Synthesis*

Pedrolide is a diterpenoid natural product featuring a novel bicyclo[2.2.1]heptane moiety recently isolated from *Euphorbia Pedroi*. This compound exhibits promising medicinal benefits, including multidrug resistance reversal activity.<sup>1</sup> Since its isolation, our team has sought to synthesize the natural product and elucidate mechanisms by which it may be constructed. Key steps in the proposed total synthesis of

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pedrolide incorporate organic reactions such as metal-catalyzed Diels-Alder and homo Diels-Alder (hDA)  $[2\pi + 2\pi + 2\pi]$  cycloadditions to form the required polycyclic scaffold. The first synthetic step is modeled by the Ni-catalyzed hDA reaction of norbornadiene with cyclohexenone, a reaction first reported by Lautens *et al.* in moderate yield.<sup>2</sup> However, improved yield and high enantioselectivity are necessary for a viable synthetic pathway to the natural product. In this work, computational and experimental investigations into existing and alternative Ni catalysts were pursued to optimize both reaction outcomes. Experiments demonstrated the viability of reducing agents in conjunction with Ni(II) precatalysts to generate the active catalytic species *in situ* and improve reaction performance. A new catalytic system employing a Ni(PPh<sub>3</sub>)<sub>2</sub>Cl<sub>2</sub> pre-catalyst and a metallic zinc reductant improves reaction yield for cyclohexenone and similar substrates with more complex functionality.

1. Ferreira *et al.* *Org. Lett.* 2021, 23, 274.

2. Lautens *et al.* *J. Am. Chem. Soc.* 1995, 117, 10276

### Poster 70

**Presenter: Raven Mingo** (University of Utah)

Mentor: Elizabeth Keating (Pediatrics)

*Social Determinants of Health in Pediatric Injury Patients in Moshi, Tanzania*

Pediatric injuries are leading causes of death and disability in low-and middle-income countries (LMICs) with children in Sub-Saharan Africa (SSA) disproportionately affected. Unstable access to social determinants of health have been shown to affect health outcomes, and pediatric patients are more heavily affected. There is a lack of scientific data and literature on social determinants of health especially in the SSA context. LMICs often do not have sufficient integration of health inequality monitoring into their health information systems. The objective of this research is to determine how social determinants of health affect the health outcomes of our pediatric injury population in Northern Tanzania. This is a prospective observational study in which a pediatric trauma registry was developed at a large zonal referral hospital in Northern Tanzania. Data collected included demographics, social determinants of health, mortality, and morbidity measured by the GOS-E Peds. Data were input into REDCap© and will be analyzed using ANOVA, Chi-squared tests, and logistic regression in SAS(Version 9.4) ©. There were 540 patients enrolled in the registry from November 2020 to June 2022. In this study we predict that social determinants of health will affect our pediatric injury population. Using a combination of ANOVA, Chi-square, and logistic regression tests, we hope to determine how social determinants of health predict outcomes including morbidity and mortality. With our predicted results we anticipate that we will highlight the need for further research on ways to sufficiently integrate health inequality monitoring into the health information system.

### Poster 71

**Presenter: Pendeza Mulibea** (Texas Christian University)

Mentor: Adriana Coletta (Health, Kinesiology, and Recreation)

*Screening and Assessment Tools to Identify and Evaluate Malnutrition Among Cancer Survivors*

Background: The prevalence of malnutrition among cancer survivors ranges from 20-70% depending on cancer type, age, and treatment history (e.g., unimodal, bi-, or multimodal therapy). The main consequences of malnutrition are diminished response to cancer treatment and increased treatment toxicities. Nutrition interventions demonstrate some utility in attenuating weight loss, muscle loss, and other treatment toxicities, while also improving energy intake, protein intake, and quality of life. There are various tools available to screen and assess individuals with chronic diseases. Missing is the identification of the most effective tools, especially in the context of cancer care. The purpose of our review was to identify the most effective malnutrition screening and assessment tools for cancer care.

Methods: We searched PubMed, Science Direct, and Scopus and reviewed the literature on malnutrition screening and assessment tools.

Results: We identified NUTRISCORE and Malnutrition Screening Tool (MST) as efficient nutritional screening tools and mPG-SGA as a simple and accurate assessment tool. Patient-Generated Subjective Global Assessment (PG-SGA) is a widely used nutritional screening tool in other chronic diseases. PG-SGA differs from modified PG-SGA; mPG-SGA excludes worksheet four (results of physical examination), which was identified as too difficult to complete by medical staff. NUTRISCORE and MST were validated using PG-SGA as a reference method; MST had a sensitivity of 84% and a specificity of 85.6%. NUTRISCORE had a sensitivity of 97.3% and 95.9% specificity.

Conclusion: In the context of cancer care, we identified NUTRISCORE as an effective screening tool and mPG-SGA as a simple and accurate assessment tool. This identification of the most effective tools will aid in identifying cancer survivors who may be at risk for malnutrition and for a proper evaluation.

### Poster 72

**Presenter: Pat Mutia** (California Institute of Technology)

Mentor: Ming Hammond (Chemistry)

*Engineering Fluorescent Cyclic di-GMP Biosensors for Dual Fluorescence and Electron Microscopy Imaging*

Cyclic di-GMP is a secondary messenger that is responsible for initiating fundamental cellular functions within bacteria such as motility, virulence, biofilm formation, and cell cycle progression. Interrogating when and where cyclic di-GMP is present within bacteria allows for further insight on pathogenic interactions, intestinal bacteria in the gut, and general bacterial signaling. The Hammond Lab has previously developed a chemiluminescent biosensor for cyclic di-GMP, which we took inspiration from to design a fluorescent, genetically encodable



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biosensor to be imaged with scanning transmission electron microscopy. We utilize the binding protein DnYcgR, that performs a conformational change when interacting with cyclic di-GMP, and a split version of miniSOG (mini Singlet Oxygen Generator), a fluorescent flavoprotein that activates when both halves meet. We performed an initial analysis of miniSOG expression by flow cytometry in pBAD and pCDF plasmids and observed a direct trend of increased expression with increased concentrations of arabinose and IPTG as respective inducers. Particularly, pBAD yielded higher overall fluorescence and miniSOG expression at optimal conditions, thus pBAD is our preferred plasmid for integrating our biosensor. Gibson assembly was then used to insert designed biosensors into the pBAD plasmid, and currently screening and sequencing is underway to identify successful integrants. We are further investigating variable flexible linker sequence configurations to connect DnYcgR and the split miniSOG pieces to restrict activation strictly due to the presence of cyclic di-GMP. In addition, we are preparing fixed samples with bacteria carrying our biosensor for electron microscopy imaging. This fluorescent biosensor with miniSOG and DnYcgR provides an alternative method to add specificity in sensing cyclic di-GMP in bacteria due to the variability in chemical substrate initial concentrations that chemiluminescent biosensors depend on, which makes quantitative measurements challenging.

### Poster 73

**Presenter: Sota Nakahama** (Southern Utah University)

Mentor: John Matthews (Physics & Astronomy)

*Finding Clear Skies in the Data from the Telescope Array Observatory*

The Telescope Array is located in the west desert of Utah and is the largest cosmic ray observatory in the Northern Hemisphere. The observatory employs two techniques to observe extensive air showers induced by ultra-high energy cosmic rays. The first technique is to sprinkle the desert's floor with scintillator detectors that sample the air shower's charge density when it reaches the Earth's surface. The second method utilizes fluorescence telescopes to observe the longitudinal development of the air shower via the nitrogen fluorescence light generated when the shower passes through the atmosphere. These telescopes have large mirrors which collect the shower light and focus it onto a camera made of photomultiplier tubes (PMTs). Thus, they are quite sensitive. They observe the skies over the array of scintillator detectors on clear, moonless nights. They are capable to see these showers tens of kilometers from the telescope, hence the density of clouds in the sky will affect the measurement of the shower development. Four Cloud Monitors were installed at the Middle Drum telescope station. These monitors measure the sky temperature in a 30-degree field of view using infra-red sensors. In addition, telescope operators go outside and visually check the skies for clouds about once an hour. They report weather codes that quantify the direction and density of clouds in the sky. Here we analyze the correlation between the operator weather codes and the sky temperatures.

### Poster 74

**Presenter: Lennae Nockideneh** (Utah State University)

Mentor: Ellen Leffler (Human Genetics)

*Comparison of Blood Group Variants in the Great Apes and Humans*

In humans, blood group variations have been associated with pathogenic infections and diseases. Examples include Rh blood group with hemolytic disease of the newborns, the ABO blood group with COVID19 and Duffy or ABO blood groups with malaria. Intriguingly, some variants in the ABO blood group are present in other primates species, including the great apes, who are also affected by malaria. In humans, blood type O is thought to be protective against severe cases of malaria caused by *Plasmodium falciparum*, a parasite that invades the Red blood cells (RBCs). However, some of the Great Apes are thought to lack blood type O. Another blood group involved in malaria susceptibility and resistance in humans is Duffy, which involves a glycoprotein on RBCs that acts as a receptor for *P. vivax*. Like *P. falciparum*, *P. vivax* invades the RBCs causing malaria. Yet, a connection between Duffy variations and malaria resistance in the great apes is unclear. More generally, the extent of genetic variation affecting blood groups in the great apes has not been explored. In this study we will analyze genetic variation in genes underlying blood groups, ABO and Duffy, in sequencing data from the Great Ape Genome Project. We will identify functional variants that are predicted to generate blood group variation and compare them to patterns of human polymorphism. This comparative approach may reveal similar or alternate genetic adaptations to malaria that have evolved in these blood group systems in the great apes.

### Poster 75

**Presenter: Tenzin Norzom** (University of Utah)

Mentor: Regina Frey (Chemistry)

*Relating student's comfort level with classmates to Social belonging in General Chemistry 1*

This study focuses on the factors that students use to describe their social belonging in General Chemistry 1, specifically the factors they use to describe their level of comfort with their peers in the classroom. Previous studies in the Frey group have shown that students' social belonging affects their grades and persistence in the general chemistry series and introductory physics 1 course at the University of Utah. These studies have also identified two main components for social belonging: sense of social belonging and the belonging uncertainty. A sense of social belonging is the sensitivity of an individual's connectedness with people such as peers and instructors and the significance of course environment that helps build an interpersonal relationship of how they feel they fit in the course. One aspect of course-level sense of belonging is the level of comfort that students have with their classmates. While these recent quantitative studies show that social

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belonging affects student performance and retention in introductory STEM courses, there are very few studies that ask students what factors they look at when describing their belonging in STEM courses and none in these introductory STEM courses. In this current study, student responses from General Chemistry 1 about their comfort level with their peers were analyzed to generate a codebook that contains eight remote and non-remote categories: Course Environment, Common Academic Experience, Identity, Perceived Ability, Student-Student Relationship/Interaction, Student-Instructor Relationship, Non-Specific, and Non Codable. In this presentation, I will present these categories, their definitions, and representative quotes for each category. I will also discuss implications for instructors to improve the inclusivity of their STEM courses, and the next steps for this project.

### Poster 76

**Presenter: Tara Jill Olson** (University of Utah)

Mentor: Lisa Diamond (Gender Studies)

*Intersectional Praxis: Social Justice within Social Science Through Community-Based Research-Practice Partnerships*

Within academia and research, the pandemic triggered a broader conversation about the lineage of intersectionality as both a lived reality and critical concept in intellectual work. Intersectionality describes the confluence of multiple categories of identity that interact and intersect each other along the dimension of race, class, gender, sexuality, and (dis)ability. At its core, intersectionality suggests that single-axis approaches (e.g., analyzing race alone or gender alone) cannot adequately address the lived experience of the individual, particularly for multiply-stigmatized persons. Only recently have researchers begun to consider intersectionality in their theories yet research agendas continue to ignore the repressive mechanisms that uphold systems of oppression including how best to research marginalized communities without inflicting additional harm knowing that our institutions of disenfranchisement have been built in some ways from knowledge generated from the ivory tower of academia. This project responds to the need to thoughtfully integrate intersectionality within research methodologies and measurements through intentional community engagement and incremental institutional change focused on the transformative goal of eradicating inequality. This involved researching different approaches to the study of marginalized communities that mitigate some of the negative aspects of community-based research by using social categories meaningfully through intersectional praxis in order to challenge previous single-axis research methods. The project highlights the significance of research-practice partnerships with community organizations/organizers as co-collaborators in the knowledge-generating process while understanding the complexity of the issues by measuring and analyzing experiences of inequality in intersectional ways. This project has important implications for social justice by highlighting the possibility for change and structural progress through community-based research that better explains the experiences of all people.

### Poster 77

**Presenter: Marco Ortiz** (Xavier University)

Mentor: Andrew Roberts (Chemistry)

*Carbon-Nitrogen Bond Cleavage to Prepare 1,10-Phenanthrolines*

A molecule called 1,10-phenanthroline, herein called phen, is a powerful ligand with uses in drug discovery and chemical catalysis. Current strategies to prepare phen derivatives are limited. In our research, we are developing a method to build phen derivatives using amine chemistry. We anticipate that amine intermediates will be readily convertible into phen derivatives. Overall, two carbon-nitrogen bonds will be traded to form a carbon-carbon double bond in a net deaminative contraction process. Developed strategies toward phen derivatives and our understanding of deaminative contraction processes will be presented.

### Poster 78

**Presenter: Sierra Parker** (Utah State University)

Mentor: Sihem Boudina (Human Genetics)

*The Effects of Cre Recombinase on BMPER Gene and APC Differentiation*

Chronic inflammation of metabolic tissues can be directly linked to obesity-induced insulin resistance, a known effect of Type II Diabetes. Bone Morphogenetic Protein-binding endothelial regulator (BMPER) gene is a growth factor that regulates bone morphogenetic protein signaling and influences adipogenesis. BMPER has been found to adapt the endothelial cells. This is significant in the reduction of insulin resistance and hyperglycemia through the downregulation of endothelial cell response to inflammatory stress. It is possible that BMPER could be a key factor for treatment of obesity-induced insulin resistance. In this experiment analysis the effects on differentiation of adipocyte progenitor cells (APCs) when implementing BMPER gene knockout. Previous studies have shown variability in differentiation of APCs infected with Ad-CMV-Cre-GFP. It is predicted that differentiation will be lower for APCs infected with Ad-CMV-Cre-GFP. Methods include extraction of perigonadal and subcutaneous white adipose tissue from 8-10-week-old high-fat-diet female and male mice. The Stromal Vascular Cells are isolated, sorted using FACS flow cytometry, and grown invitro in progenitor media for 72 hours. The sorted adipocyte progenitors were grouped and underwent protocol for Ad-CMV-Cre-GFP and Ad-CMV-GFP infection and differentiation. One group of cells was used for pre-differentiation infection and the other for post-differentiation infection. Analysis of results was carried out through BODIPY staining, RNA extraction, cDNA analysis and qPCR analysis. Results of BODIPY staining analysis show a low variability in differentiation between -Cre and +Cre groups. Female Visceral Progenitors were the only group with significant variability in BMPER expression after gene knockout.

**Poster 79**

**Presenter: Shandra Payne** (University of Utah)

Mentor: Derek Dossdall (Surgery)

*Pressure-Volume Loops Identify Decreased Contractility in Heart Failure*

Pressure-Volume Loops Identify Decreased Contractility in Heart Failure

Introduction: Every 34 seconds someone in the U.S. dies from heart disease. Nationally, across all genders and most ethnic-racial groups, it is the leading cause of death. Pressure-Volume (PV) loops are a valuable tool in the study and management of heart failure (HF), providing important information about cardiac mechanics. In this animal study, we demonstrated that PV loops identify the decrease in contractility of the heart following the induction of myocardial infarction (MI) by measuring left ventricular end-systolic pressure-volume relation (LV-ESPVR) and end-diastolic pressure (LVEDP).

Methods: 13 healthy adult dogs (30±5 kg) underwent multiple ligations of the LAD via a thoracotomy to induce MI. Echocardiograms were performed weekly to monitor LV ejection fraction (LVEF) percentage. Over 8-15 weeks, ten dogs (77%, Group A) developed moderate HF with the end-point of LVEF <40% and NT-proBNP >900pmol/L. The other three dogs (Group B) did not meet the moderate HF criteria. PV loops were acquired by placing the pressure conductance catheter into the LV via the aortic valve. The effect of inferior vena cava occlusion (IVCO) and release on ESPVR was studied in both groups during baseline procedure before thoracotomy and at the end-point.

Results: Group A exhibited a significant change in LV contractility (1.51±0.51 vs. 1.09±0.58 mmHg/mL, p<0.001) and LVEDP (6.02±1.02 vs. 10.04±1.97 mmHg, p<0.001) from the baseline to the end-point. In group B, there was a reduction in LV contractility (1.38±0.18 to 0.92±0.30 mmHg/mL, p=0.211) and an increment in LVEDP (7.13±2.80 to 8.13±1.78 mmHg, p=0.313), though the change was not significant. Finally, during IVCO release, both groups showed a non-significant difference in ESPVR from the baseline to the end-point (Group A: 1.42±0.44 vs. 1.24±0.55 mmHg/mL, p=0.361 and Group B: 1.34±0.42 vs. 0.87±0.25 mmHg/mL, p=0.09).

Conclusion: PV loops demonstrated a substantial change in LV contractility and LVEDP in those who developed moderate HF

**Poster 80**

**Presenter: Kylie Peasley** (Utah State University)

Mentor: Catherine Loc Carrillo (Biochemistry)

*Does following the manufacturer's directions for disinfectant wipes make a difference in how well the surface is cleaned?*

Background: Multidrug resistant organisms (MDROs) are bacteria that are resistant to many common antibiotics used to treat patients with bacterial infections. MDROs are most commonly transmitted from patient to patient or via high touch surfaces (e.g. door handles, medical equipment) in places ranging from hospitals to long term care facilities. Proper hand washing hygiene as well as surface and equipment disinfection are simple ways to reduce transmission. Disinfectant wipes contain chemicals that kill the bacteria on surfaces.

Disinfecting wipes are one of the most commonly used items to clean and disinfect surfaces. The manufacturer's provide directions for use on the product, but does following them really matter? What is the difference in following the manufacturer's directions versus just quickly wiping the surface? This experiment was set-up to determine the amount of bacteria left on a surface when using the disinfecting wipes by following the manufacturer's directions versus a quick 1 minute wipedown.

Method: MRSA (Methicillin-resistant Staphylococcus aureus- an MDRO) was used in this project. A MRSA suspension was pipetted onto a 17x29mm face-shield surface sample and set to dry for 1 hour. After drying, the samples were placed into 3 groups. Group 1 tested the manufacturer's directions (i.e., wipe surface and use enough wipes to make sure the surface remains visibly wet for 4 minutes); Group 2 tested an alternative method (i.e., wipe surface and allow 1 minute for the surface to "dry"); Group 3 was the untreated control (i.e., a non-disinfectant wipe and used to follow the same procedure as Group 1).

Results: Following the manufacturer's directions resulted in a significant reduction of bacterial load compared to the alternative method and the untreated control.

Conclusion: This information can help those who use the product maximize the disinfection.

**Poster 81**

**Presenter: Re Perry** (New York University)

Mentor: Michelle Debbink (Obstetrics & Gynecology)

*Hearing the Voices of Native Mothers*

## Session II 10:30AM-12:00PM

Nationally, American Indian and Alaskan Native women are 54% more likely to develop Severe Maternal Morbidity (SMM) than their Non-Hispanic White counterparts. We hypothesize that factors such as historical traumas (child-mother forced separation, rushed c-sections, forced sterilizations) and systemic barriers (access to birthing centers and doulas, generational poverty, culturally insensitive care) impact patient-physician communication, produce mistrust, and impact health outcomes and quality of care. Qualitative data is collected from a series of 8-10 listening groups across Utah that include 8-10 women from each tribe, who have given birth in the last five years. Participants are compensated for their contributions to a semi-structured conversation about pregnancy complications and experiences. The first Talking Circle was conducted in English virtually on March 20, 2022, via Zoom and was recorded (audio and video) and transcribed. Preliminary results from focus groups suggest: cultural practices and community are important to the pregnancy experience of urban Native women, the first pregnancy and delivery is more difficult due to a lack of information provided to the mother prior to labor, and there is mistrust towards providers that stems from the physician's insensitivity in delivering care. There is a lack of research tracking the outcomes of culturally sensitive community interventions regarding prenatal disparities for Native Americans. Community based interventions should consider ways to implement cultural sensitivity and advocacy into prenatal care and labor, most realistically through the form of a culturally trained doula or midwife. Women should also have community spaces to learn about pregnancy early in the experience.

**Poster 82** – n/a

### Poster 83

**Presenter: Paola Pina** (Brigham Young University)

Mentor: Jen Doherty (Population Health Sciences)

*Ovarian cancer survivorship: associations between health-related quality of life and physical activity*

Ovarian cancer (OC) is a fatal disease and has the highest mortality rate of all cancers of the female reproductive system. Nevertheless, with treatment improvements, there has been an annual 3% decrease in OC mortality observed in the U.S. With an increased number of OC survivors, research on improving health-related quality of life (HRQOL) is needed. Previous studies have demonstrated a positive relationship between HRQOL and physical activity in cancer-free populations. Public health guidelines provide broad recommendations for physical activity in cancer survivors, similar to guidelines in cancer-free populations, which include reducing sedentary time. However, there is limited research on the relationship between HRQOL and physical activity within OC survivors. The purpose of this study is to describe the relationship between HRQOL and sedentary time in OC survivors at the time of diagnosis and one year afterward.

The Ovarian Health and Lifestyle Study recruits patients recently diagnosed with malignant epithelial OC, ages 21-89, seen at Huntsman Cancer Institute and/ or University of Utah 2018-2022. Study participants were given a questionnaire via mail or by telephone at several timepoints, including the time of diagnosis (baseline; n=30), 3 months (during treatment; n=25), and 12 months (post-treatment; n=13). Questionnaires include validated instruments on HRQOL and physical activity, as well as a novel instrument on intention to change physical activity and other lifestyle behaviors. Double data entry was performed for each of the mailed questionnaires received and recorded in a REDCap database. Preliminary analyses shows promising findings that OC survivors decrease their sedentary time (minutes) per week, as well as increase their reported HRQOL, over the year following diagnosis. Further research is needed to identify whether decreasing sedentary time, and thereby increasing physical activity, is the cause of a higher HRQOL or whether an individual's HRQOL is a motivating factor for increased physical activity.

### Poster 84

**Presenter: Timina Inisa Powaukee** (University of Utah)

Mentor: Fatma Tuncer (Surgery), Kaylee Scott, MD; Jack Sudduth, MD

*Immediate Lymphatic Reconstruction for the Prevention of Cancer-Related Lymphedema: Preliminary Experiences of a Single Center*

Cancer-related lymphedema affects 20-45% of patients with breast cancer and up to 50% of patients with melanoma and develops after lymphatics are disrupted during lymph node dissection or radiation. It results in pain, swelling, and decreased quality of life. A lymphovenous bypass procedure is done to re-establish lymphatic flow by rerouting cut lymphatics into nearby veins and may be performed at the time of lymph node dissection in a procedure known as immediate lymphatic reconstruction (ILR). ILR is supported by a growing body of evidence, though data regarding long-term efficacy is lacking.

In this study, we aim to describe the experience of ILR at our institution through a retrospective chart review using a REDCap database.

Thirty-seven patients underwent ILR at the time of lymphadenectomy. Nine patients were excluded from analysis due to pre-existing lymphedema. Breast cancer affected 70.4% of patients, while 25.9% had melanoma and 3.7% had squamous cell carcinoma. The majority of our patients underwent adjuvant radiation therapy (73.1%). Patients underwent LVA in the axilla (74.1%), inguinal region (22.2%), and antecubital fossa (3.7%). The average follow-up duration was 7 months. 85.2% of patients did not have lymphedema based on the physical exam at their last follow-up appointment.

Our findings indicate that ILR may be a safe and effective strategy for reducing post-operative lymphedema in the cancer population.

**Poster 85**

**Presenter: Shree Prakash** (University of Utah)

Mentor: James Gagnon (School of Biological Sciences)

*Interpreting the consequences of single-cell CRISPR perturbations through label transfer*

Single-cell RNA sequencing (scRNA-seq) permits the measurement of gene expression at single cell resolution, enabling a new understanding of the cell and molecular responses to perturbations in developing animals. However, a challenge for using scRNA-seq data exists in defining shared cell types across samples. My objective is to develop an agnostic computational framework to transfer cell type labels onto a perturbed sample and analyze how gene expression and cell type abundances are affected. To test this label transfer method, I focused on the gene regulatory network that establishes mesoderm cell types in the zebrafish embryo. The genes of interest in this network, *noto*, *tbxta*, and *tbx16*, are well-known mesoderm regulators, but have not been studied at single-cell resolution. Using CRISPR, I perturbed each transcription factor and generated scRNA-seq libraries for each mutant at 24hpf. Each condition's gene expression profiles were processed and integrated through Seurat's clustering workflow to aggregate the cell populations present in all conditions. Marker genes for each cluster of the integrated object, with all perturbed conditions, act as the input for the annotation framework to identify the most likely cell type for each cluster. By employing this framework, I identified how my gene perturbations impacted different cell types present in the developing embryo. The annotation framework has allowed me to study mesoderm patterning interactions between *noto*, *tbxta*, and *tbx16* at a molecular level; and this method is broadly useful for studying cell and gene expression in other single-cell perturbations.

**Poster 86**

**Presenter: Maya Rabbitt** (University of Utah)

Mentor: Hamid Ghandehari (Pharmaceutics & Pharmaceutical Chemistry)

*Thermoresponsive Bioinks for Printing Structures Containing Cells*

Bioprinting has been considered for tissue engineering applications in recent years. The complexity of creating a printable, yet stable, bioink has caused concessions to be made on cytotoxicity in some cases. The goal of this project is to optimize the printing of a thermoresponsive bioink, as to create an environment that supports cell viability and accurate printing of structures. A 0.75ml of 5% alginate and 0.25ml of 60mM calcium chloride bio ink was used on the pneumatic print head of a BIOX bioprinter to determine general trend lines of optimal printing parameters. This bioink was then compared to two other formulations of alginate, calcium chloride, and collagen. Cells were added to the successful collagen containing bioink, creating a 0.6ml of 5% alginate, 0.2ml of 60mM calcium chloride, 0.2ml of 5 mg/ml collagen, and  $1 \times 10^6$ /ml cells solution. The thermoresponsive bioink is made from 3% alginate, 25mM calcium chloride, 1 mg/ml collagen, and 6% SELP. The printability of this ink was observed and a live/dead assay was performed. A clear trendline was observed in the printing of precrosslinked alginate with the pneumatic printhead. The bioink's rheological properties changed with the addition of collagen and cells. The bioink contained live cells at the time the live/dead assay was performed. This suggests that with the addition of the thermoresponsive protein the ink's composition will be able to be further optimized, and risks to cells better avoided. An accurate print is possible on the machine once the placement of the trendline is established.

**Poster 87**

**Presenter: Kevin Ramos** (University of Utah)

Mentor: Jim VanDerslice (Family & Preventative Medicine)

*Historic Traffic Data and Populated Weighted Centroids*

Pollution has been an issue in Utah since pioneers settled in the greater Salt Lake area during the mid-19th century. Articles regarding the gathering of 'smoke' in the valley tell a story of a worrisome population attempting to find solutions to this issue(Williams, 2021). Pollution measurement efforts were initiated in the early 21st century but a lack of sensors has historically created a gap in the data where assumptions must be made. This lack of resolution creates a large margin of error making it difficult to assess how different types of populations are affected by their ambiance. This study has taken into account the effects of vehicular pollution outputs as one of the main sources of exposure to pollutants. Historic traffic data was manually extracted from Utah data archives. These hand-drawn maps containing points of average traffic at a given year dating back to the 1940's were georeferenced and digitized using ArcGIS Pro. This data has the capability to interpret pollution exposures for the Utah population at a finer spatial resolution. This can give researchers a glimpse of how pollutants have impacted historic health outcomes such as cancer, blood lead levels in children, etc.

**Poster 88**

**Presenter: Jade Robinson** (Johns Hopkins University)

Mentor: Bradley King (Health, Kinesiology, and Recreation)

*Behavioral Mapping Investigations of Developmental Advantages in Motor Learning*

The schema effect is the phenomenon that can be observed when the acquisition of novel information is facilitated by prior, already consolidated knowledge. The degree of similarity between the novel and previously learned information, as well as the developmental stage

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of the individual acquiring it, contribute to the efficiency of the integration into the existing schema. Although there is evidence that previously learned information improves organizational processing of new information, previous literature failed to address the schema effect in the context of cognitive development throughout the lifespan. Therefore, the current study aims to examine the schema effect within the motor domain in children through the manipulation of a motor sequence learning paradigm. Preliminary behavioral data from 44 7-35 year olds have been acquired, using a bimanual Serial Reaction Time Task (SRTT) administered through an online data acquisition platform. Twenty-four hours after the acquisition of an initial motor sequence, participants learned a new sequence that was either highly compatible or incompatible to the initial sequence. The strength of the schema effect will be examined across the different developmental stages as well as the effect of the similarity between old and new motor movements. The results of the study will contribute to the narrow selection of literature on the schema effect and motor learning; however, further investigation of how schemas influence motor learning will also be necessary to better understand how learning and motor movements inherently change throughout the lifespan, and improve relevant clinical practices.

### Poster 89

**Presenter: Mary Schaelling** (University of Utah)

Mentor: Michelle Mendoza (Oncological Sciences)

*The Presence of Tenascin-C and its effect on Early Stages of Lung Adenocarcinoma*

Lung cancer is the most common cause of cancer death in males and females, claiming more than a million lives per year. The Extracellular Matrix (ECM) plays a vital role in many cellular functions such as cell movement, growth, communication, and attachment to neighboring cells. The architecture and composition of the ECM regulate cancer progression. Due to the complexity of the ECM, its role in cancer promotion is still poorly understood as well as the effect of Tenascin-C on the architecture of tissue at the early stages of lung adenocarcinoma. It has been shown that high expression of the ECM glycoprotein Tenascin-C (TNC) correlates with severe lung adenocarcinoma. TNC has been shown to influence the architecture of collagen and promotes path-like structures in vivo. Our lab has found fibroblast-associated TNC enrichment in the early stages of lung adenocarcinoma.

Due to the formation of these structures within collagen, it is plausible that the presence of Tenascin-C promotes significant cell movement within the ECM. We hypothesize that TNC is thickening and bridging collagen fibers creating passageways that cells can utilize for migration in the early stages of lung adenocarcinoma.

To test our hypothesis, we optimized 3D invasion cell assays and immunofluorescence staining, allowing us to study the role of TNC in tumor cell migration. We also set up transfection to knock out TNC within fibroblast to further test our hypothesis. Understanding the ECM and its role in lung cancer progression will help develop effective methods to prevent cancer migration.

### Poster 90

**Presenter: Anna Shcherbakova** (Texas A&M University)

Mentor: Michael Vershinin (Physics & Astronomy)

*Effects of Temperature on the Rigidity of Microtubules*

Microtubules (MTs) are polymeric filaments made up of the tubulin dimer subunits. A small tri-phosphate molecule - typically guanosine triphosphate (GTP) - is needed to form longitudinal bonds between subunits. GTP is then hydrolyzed into a di-phosphate (GDP) over time. MTs are the most rigid element of the cytoskeleton and play a crucial role in cell shape maintenance. They also participate in cellular functions such as cell movement, division, growth, and signaling. They allow proteins and other compounds to be transported through different parts of cells. It is not well understood how temperature changes affect the microtubule's rigidity. To investigate this, we used MTs polymerized with either GTP or GMPPCP (an analog of GTP that is non-hydrolysable). We also used taxol to further assist MT polymerization. MTs were incubated at set temperatures over a poly-Lysinated glass surface which allowed us to immobilize them and hence capture their thermal conformations. We then analyzed their rigidity by calculating their persistence length using a custom modified open-source software for Matlab called FiberApp. Our results are not complete yet, however so far, based on our data, microtubule rigidity appears to be independent of temperatures from 0C to 40C. This confirms some published research but overturns other results and helps our understanding of the molecular mechanisms underlying MT rigidity as a function of temperature. The applications of our research will contribute to the knowledge of how microtubules function in the body since there is very little research studying temperature effects on microtubules, and the temperatures that have been studied did not go to the extremes. The next steps for our research are to try to create microtubules with GMPCPP, another non-hydrolysable analog of GTP - a preparation which would not contain taxol and should represent a more accurate depiction of how microtubules behave inside cells, as well as allow further direct comparisons with published research.

### Poster 91

**Presenter: Margaret Shepherd** (Macalester College)

Mentor: Dave Kieda (Physics & Astronomy)

*Calibration of VERITAS Stellar Intensity Interferometry with Vega*

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The VERITAS-SII (Very Energetic Radiation Imaging Telescope Array System with Stellar Intensity Interferometry, or VSII) collaboration is aimed at measuring the properties of stars, such as the angular diameter (the apparent angle that the diameter of a star takes up on the sky), using optical interferometric observations from the four VERITAS telescopes. In this project, the angular diameter of the star Vega is estimated along with the zero-baseline normalization factor associated with the VSII instrument. The data used in this project was taken at VERITAS during moonlight hours in Fall 2021 and Spring 2022. Vega's angular diameter is found to be 2.40 milliarcseconds with 1-sigma errors of 0.49 mas (lower) and 0.55 mas (upper). The minimum angular diameter is well constrained, but at the 3 sigma level, the maximum angular diameter is unconstrained. Though the uncertainty is fairly large, this estimate (specific to the wavelength that VERITAS observes at) appears consistent with measurements at longer wavelengths. In addition, these observations provide a useful test of the largest angular diameter that VERITAS can measure. Measurements of the instrumental normalization factor came from the stars  $\alpha$  Lyr (Vega),  $\gamma$  Cas, and  $\gamma$  Ori. The measured normalization has a large associated uncertainty but is within the uncertainty of previously published values. The uncertainty of the instrumental normalization factor can be decreased through observations made under good weather along with further improvements to the VERITAS telescopes' hardware.

### Poster 92

**Presenter: Mary Smith** (University of Utah)

Mentor: José Gutierrez (Education, Culture & Society)

*Allotments and Arithmetic: Land Dispossession in Indian Boarding School Mathematics Curricula, 1879-1932*

This project draws on the work of four scholars—Holm (2005), Ornelas (2007), Sepulveda (2018), and Tuck & Yang (2012) to interpret math word problems as instances of internalized colonization. This project uses Holm's (Holm, 2005) framework of the three phases of colonialism to analyze mathematical word problems in the Estelle Reel Collection. The phases are 1) Disruption and Boundary Making, 2) Forced Assimilation, and 3) Internalized Colonialism (Holm, 2005). This project reveals the mathematics instruction in Indian boarding schools reflected the tactics in the three phases. Analysis of the social and political content embedded in these word problems also indicate a connection to the idea that teaching private property ownership would force indigenous people to abandon their cultural heritage (Holm, 2005), develop a sense of individualism (Holm, 2005), and empower a sense of freedom to the owner (Holm, 2005). This idea of private property ownership is antithetical to views of indigenous people, who draw a deeper connection to life through land and environment (Sepulveda, 2018). Through settler colonialism portrayals of land, land is transformed into property and the only human relations to land that exist are as its owner (Tuck & Yang, 2012). By drawing upon the math word problems in the Estelle Reel collection and Annual Reports of the Commissioner of Indian Affairs, we highlight the math teachings that were used to change the way Indigenous peoples viewed and valued land to assimilate them into white American society. The hopes of this project are to fill historical gaps around Indian boarding schools, challenge existing notions that mathematics is objective, and highlight implications for teacher education.

### Poster 93

**Presenter: Nyah Smith** (North Carolina A&T State University)

Mentor: Kelly Baron (Family & Preventative Medicine)

*Sex differences in sleep and circadian rhythm changes during the COVID-19 Pandemic*

The COVID-19 pandemic affected daily routines across the world. For women, the effects on the workforce were significant, with a far greater number of women needing to stop working due to loss of school and childcare but sex differences on other routines such as sleep are unknown. We had the opportunity to evaluate objective sleep and circadian rhythm data among individuals who were enrolled in a 12-month longitudinal study, starting in 2019. The goal of this project is to evaluate sex differences in the shifts that occurred in sleep and circadian timing during the COVID-19 Pandemic. Results will have implications on the effects of the pandemic on sleep among men and women. Further research will need to determine whether changes persist over time, due to factors such as remote and hybrid work.

### Poster 94

**Presenter: Riya Soneji** (University of Utah)

Mentor: Sarah Shapiro (Neurology)

*Linking Giant Cell Arteritis with Gastrointestinal Involvement*

Giant Cell Arteritis (GCA) is an autoimmune mediated vasculitis, which affects medium and large sized arteries. It is typically seen in adults older than 50 years of age. GCA is known to affect the temporal arteries, which is why this disease is commonly referred to as Temporal Arteritis. With inflammation of the temporal arteries leading to decreased blood flow, common signs and symptoms of GCA include head pain, scalp tenderness, jaw pain, vision loss, and anorexia. With the mechanism of the anorexia not well elucidated, I am performing a literature review search to investigate gastrointestinal involvement in GCA patients to further understand the mechanism of action and clinical explanation for anorexia in GCA.

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### Poster 95

**Presenter: Julia St. Andre** (University of Utah)

Mentor: Shanti Deemyad (Physics & Astronomy)

*Creating an Optical System for Electronic Raman Spectroscopy at Extreme Conditions: Probe Superconducting Gap*

Superconductors are unique materials with the ability to conduct electricity with zero resistance and exhibit perfect diamagnetism. The application of high pressure allows for tuning the density of materials and is an important method for studying superconductors. High-pressure conditions similar to those present at the core of the Earth can be achieved in a laboratory by using a Diamond Anvil Cell (DAC). Raman spectroscopy is a good method that is applicable for studying superconducting samples in Diamond Anvil Cell (DAC) measurements and allows for data collection under extreme conditions of pressure and temperature. The superconducting gap changes with temperature, starting from zero at transition temperature and increasing to a maximum value at  $T=0K$ . As such, the samples are held within a cryostat in order to achieve these temperatures. Additionally, the sample size in these experiments is very small, about 10-100 microns in diameter. Therefore, it is necessary to create a Raman spectroscopy setup that can work at a long distance from the sample and still produce high-quality images from outside the cryostat window. Using a dual-parabolic mirror setup, we created an imaging system in order to achieve electronic Raman spectroscopy at a long distance. This is achieved by doing precise alignment with a laser and using several optical standards to create a light path that is accurate and level. Once this setup is fine-tuned and ready for imaging, we will utilize the optical imaging set up to study the superconducting gap of several known materials below their critical temperatures, including MgB<sub>2</sub> ( $T_c=39K$ ), Pb ( $T_c=7.2K$ ), and Nb ( $T_c=9K$ ). Once these preliminary calibrations have been performed, this method will be used to study new superconducting materials in the lab.

### Poster 96

**Presenter: Kai Sudweeks** (Utah Tech University)

Mentor: Man Hung (Orthopaedics)

*Role of Vitamin D in Cardiovascular Disease*

**Objectives:** There is a controversial relationship between vitamin D and cardiovascular disease (CVD) in previous studies in which varying thresholds of vitamin D have prompted differing results. The aim of this study was to investigate what levels of vitamin D are optimal for prevention of CVD.

**Methods:** This study utilized the 2015-2018 National Health and Nutrition Examination Surveys (NHANES) database and included adults aged 20 years and older who reported a history of CVD. CVD was defined as a combination of stroke, heart attack, heart failure, and coronary heart disease. Descriptive statistics for participants' demographic characteristics, vitamin D levels, CVD, and risk factors were performed and analyzed. Chi-square tests and t-tests were applied to examine differences in participant characteristics according to whether they had CVD. Regression models were used to explore the association between vitamin D levels and the CVD.

**Results:** A total of 9825 participants met the study criteria. The mean age of participants was 50.28 years (95% CI= 49.93-50.63). Most of the population were female (52.1%) and non-Hispanic white (34%). Results also showed that the majority of participants had normal VD level (64.8%) and never been told that they had CVD (89.5%). The regression model displayed a significant relationship between subjects with VD deficiency, insufficiency and CVD. Participants with vitamin D deficiency or insufficiency had a higher likelihood of having CVD than those with normal vitamin D levels. No statistically significant relationship was found between CVD and vitamin D adequacy.

**Conclusions:** Both vitamin D deficiency and insufficiency were associated with an increased risk of CVD. For future prevention of CVD, healthcare professionals may recommend the use of vitamin D supplementation to improve cardiovascular health in U.S. adults aged 20+ years old.

### Poster 97

**Presenter: Tara Tazehabadi** (University of Utah)

Mentor: Martin Horvath (School of Biological Sciences)

*Bioinformatics Detecting Functional Interactions Important for DNA Repair Enzyme MUTYH*

MutY and its homologous protein MUTYH are DNA base mispair proteins that recognize, excise and repair a mismatched Guanine: Adenine pair, shortly known as the 8-oxoG: A mismatch. The 8-oxoG: A mismatch often leads to the formation of life-threatening diseases such as lung, rectal, and colon cancers. In order to understand the behavior of these proteins and make predictions about their reaction in different environments, it is important to observe and study the unique interactions between them and their partner proteins, as well as the intramolecular interactions between their domains.

To observe and study something as immense as the functional interactions of proteins in many ages of evolution, Bioinformatics and a statistical calculator known as Mutual Information (MI) calculator has been used using R studio software to measure co-dependency between two given random variables. The MI calculator will return Mutual Information (MI) Scores which will be indicative of coevolution between the two variables. In part one of the experiment interesting interactions between the two domains of proteins MutY and MUTYH,



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N- and C- terminal domains were observed in approximately 50 to 5000 species, followed by observing interesting interactions between MutY and its partner proteins and MUTYH and its partner proteins, both looking at 50 to 250 species, in part two of the experiment. As the MI score of codependency and coevolution between the separate variables were analyzed, conclusions have been drawn such that the value of the MI score can be dependent on the number of species used in each experiment, and some diversification of the functionally important residues is necessary for MI score to be calculated, and unique interactions as indicated by MI score might present structural significance when visualized in a 3D environment. These interactions at the molecular level prove that proteins are evolving together, across species, despite their emergence from a given point of time in evolution and further studies can open doors for medically targeting specific regions.

### Poster 98

**Presenter: Kaila Toledo** (Weber State University)

Mentor: Jared Rutter (Chemistry)

*Studying Lactate Metabolism in Cardiomyocytes During Hypertrophy and Heart Failure*

Heart disease is the second leading cause of death in the American Indian and Alaska Native population, with about 14% relating to heart failure. Heart failure is a cardiovascular disease, resulting from the heart's limited ability to fill and/or pump blood throughout the body. It is known that cardiomyocytes do not contain fuel reserves and thus their metabolism is flexible and dynamic to maintain sufficient ATP production to support the heart's continuous pumping of blood. We have previously identified the pyruvate-lactate metabolic axis as a critical node in heart biology. The mitochondrial pyruvate carrier (MPC) and the lactate exporter, monocarboxylate transporter 4 (MCT4), are essential control points for this axis. However, how lactate consumption and metabolism affects the pyruvate-lactate axis in the heart remains poorly understood. We will perform <sup>13</sup>C heavy carbon lactate stable isotope tracing experiments in H9c2 cardiomyoblast cells in combination with various hypertrophic inducing drugs to begin to understand lactate metabolism under these conditions. We will also utilize VB124, an MCT4 inhibitor, to mitigate hypertrophy and determine its effects on lactate utilization and flux. These experiments will expand our current knowledge of heart metabolism and potentially identify novel therapeutic targets to treat this condition.

### Poster 99

**Presenter: Jelly Uzoigwe** (University of Utah)

Mentor: Neli Ulrich (Population Health Sciences)

*Clinicodemographic Characteristics of Rural and Urban Colorectal Cancer Patients in the ColoCare Study at Huntsman Cancer Institute (HCI)*

**Purpose:** Colorectal cancer (CRC) is the 3rd most common cancer and 2nd leading cause of cancer-related deaths in the United States. Patients living in rural areas are disproportionately affected by CRC, especially later stage diagnosis, and have lower survival rates than their urban counterparts, with unique risk factors. The focus of this project is to examine clinicodemographic characteristics by rurality among CRC patients.

**Methods:** The ColoCare Study is a large prospective cohort of newly diagnosed CRC patients. This analysis includes 459 CRC patients from the study site at HCI. Age, sex, race, ethnicity, tumor stage and site, body-mass-index, marital status, and education were assessed by patient-reported questionnaires and/or electronic medical record data. Rurality was computed from zip codes and the Rural-Urban Commuting Area Codes classification system. Socioeconomic status was assessed using the National Area Deprivation Index, with higher percentile scores indicating more disadvantaged areas. To determine if clinicodemographic characteristics differed between residents in urban versus rural areas, we used t-tests for continuous variables and c-square tests for categorical variables.

**Results:** Mean age was 57 years, with 46% female, 92% White, 9% Hispanic/Latino, 59% from Utah, and 42% (n=191) residing in rural areas. Rural vs. urban patients were more likely to be older (59 vs. 56 years; p=.03), diagnosed with stage III disease (50% vs. 37%; p=.04), have a lower education level (high school graduate or less=27% vs. 15%; p=0.03), and live in a more disadvantaged area (45 vs. 36 percentile; p<0.001). Urban vs rural patients were more likely to be diagnosed with stage II or IV (p=.04).

**Conclusions:** These findings suggest there were differences by tumor stage, between cancer patients living in rural compared to urban areas. This may point towards lower uptake of CRC screening in rural populations. Further research is needed to examine health disparities for CRC patients living in rural areas to develop effective community outreach programs.

### Poster 100

**Presenter: Jessica Venegas** (University of Utah)

Mentor: Arabella Young (Pathology)

*Understanding Cytokine Responses in Cancer Patients That Develop Immune Checkpoint Inhibitor-induced Diabetes*

Cancer immunotherapy is a form of cancer treatment that educates the immune system to recognize and attack cancer cells. In particular, two clinically approved antibodies known as immune checkpoint inhibitors (CPIs), which block cytotoxic T lymphocyte antigen-4 (CTLA-4) and programmed death-1 (PD-1) have provided improved survival benefits for patients with a range of cancer types. However, by activating the immune system, we also observe a broad range of immune-mediated side-effects. There are currently no biomarkers to

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identify which patients may be susceptible to the development of CPI-induced immunotoxicity and the mechanism by which they occur remains unclear due to the rarity of certain irAEs, their variable timing, and an inability to access the irAE-affected tissue site. In this study, we aimed to better define potential clinical and demographic information alongside the dysregulation of longitudinal serum proteins, such as cytokine responses, to assess their ability to predict the development of CPI-diabetes in CPI-treated stage IV melanoma patients. We identified that certain cytokines appeared to be upregulated preceding initiation of CPI treatment in patients with CPI-diabetes (including IL-27, EOTAXIN, SFAS/TNFRSF6), whereas others appeared to be significantly modulated during the treatment course (including IL1A and MIP1B/CCL4). By comparing serum concentrations of circulating factors at baseline, early during treatment and near to initiation of CPI-induced diabetes, we identified some potential drivers of CPI-associated diabetes, which could represent biomarkers for risk or potential therapeutic targets to inhibit irAEs. We will next assess the mechanism for how these changes in the serum promote differential immune responses that could contribute to CPI-related diabetes, which may also provide greater insight into additional mechanisms of type 1 diabetes. Together, this study has allowed us to identify a potential predictive cytokine profile that may assist in determining cancer patients that are at higher risk of developing CPI-induced diabetes.

### Poster 101

**Presenter: Olivia Vielstich** (University of Utah)

Mentor: Ivis Garcia (City & Metropolitan Planning)

*Why They Stay: Puerto Rican Businesses in the Flood-Zone*

In 2017 Hurricane Maria, a category five hurricane, hit Puerto Rico. The destruction caused by Maria is still felt around the island to this day. Many people continue to live in areas that are at high risk of future disasters. Resources that offer to move residents to more safe areas exist, but many people choose to stay in the danger zone. This project focuses specifically on businesses that chose to continue operating within the 100-year flood zone as established by FEMA. Through 125 in-person surveys, 75 in Loiza and 75 in Comerio, Puerto Rico, we sought to understand why they stay. Our findings showed that residents of these communities were heavily influenced by the interdependencies they had with residents and other local businesses. Simply moving to another area would disrupt these interdependent relationships and could be harmful to their livelihoods or communities. For many businesses, the risk of staying in a high-risk disaster area is lower than the risk of starting over in a new place. More research can be done to understand how organizations offering assistance can make their resources more accessible to residents in Loiza and Comerio, as well as tailor assistance to better suit the wants and needs of those who are seeking aid.

### Poster 102

**Presenter: Sarah Villadelgado** (William & Mary)

Mentor: Aaron Puri (Chemistry)

*Activation of Biosynthetic Gene Clusters in Methanotroph and Methylotroph Cocultures*

Natural products provide an evolutionary advantage for the producing organism due to their potent bioactivities and have been used in applications of modern medicine, including antibiotics and antifungal therapeutics. Enzymes responsible for producing natural products are encoded as groups of genes known as biosynthetic gene clusters (BGCs). With advancements in genome mining, it has become easier to identify BGCs that might encode for key natural products of interest. However, a common obstacle is that many BGCs are not expressed when culturing these bacteria in a lab setting due to their lack of surrounding environmental stimuli. These are known as silent BGCs. A method of activation we have explored is coculturing a bacterium with BGCs of interest with other bacteria from the same environment. Our lab has previously identified BGCs in multiple strains of methane-oxidizing bacteria, also known as methanotrophs. Methanotrophs can sequester methane from the environment, using it as an energy source, and also can convert it to methanol, supporting cross-feeding non-methane-oxidizing bacteria known as methylotrophs. Due to this known metabolic link between these two types of bacteria, in this work we cocultured 3 strains of methanotrophs with 2 strains of methylotrophs to activate silent BGCs of interest. We are currently comparing natural product extracts of these bacteria grown alone and in coculture using mass spectrometry and growth inhibition assays. Discovering new natural products through coculturing can help us understand the chemical ecology of methanotrophs with other bacterial species in the environment as well as identify new therapeutic leads.

### Poster 103

**Presenter: Tatiana Willis** (Mississippi State University)

Mentor: Heather Hayes (Physical Therapy and Athletic Training)

*Function and Quality of Life over one Year for Individuals Post-Stroke*

Every year, more than 795,000 people have a stroke, which is the leading cause of disability in the United States. Stroke can negatively impact quality of life. Quality of life (QoL) in individuals is worse after stroke with increasing disability. The purpose of this study is to describe the functional ability using the Activity Measure for Post-Acute care, Computer Adapted Test (AM-PAC) and quality of life using the EuroQol 5 Dimension 5L (EQ-5D-5L) in individuals post-stroke at four time points over one year. A prospective study, on 123 individuals with acute ischemic stroke were assessed at four time points, at discharge from the acute hospital, at discharge from an inpatient rehabilitation facility, at 6-months and 12-months. The primary outcome measures assessed function and QoL. The AM-PAC measures the degree of difficulty or assistance in performing 3 domains: Basic Mobility, Daily Activity, and Applied Cognition. The EQ-5D-5L has

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questions in 5 dimensions; mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Characteristics of individuals in the study: 55 females; average age 65.3 years (range 26.5 - 96.5); 39 employed, 16 unemployed, 67 are retired; 73 left hemiparesis, 3 bilateral hemiparesis; 82 did not receive tPA; average length of acute care stay is 7.1 days (range 1 - 21). The average BMI is 29.1. 82 of the patients did not receive tPA. This study is still in progress and currently does not have results. This study will help clinicians understand the long-term impact of stroke disability and function over 1 - year.

### Poster 104

**Presenter: Whitney N. Willis** (North Carolina A&T State University)

Mentor: Darrah Sleeth (Occupational and Recreation Therapies)

*Aerosol Containment Safety Device*

In the midst of COVID-19 and increasingly high risks of respiratory infectious diseases of healthcare providers, the improved device for aerosol containment became a beacon of light for the future of healthcare. In this summer research of the aerosol containment device modeling, I learned that two different designs were used to analysis the disperse of infectious aerosolized particulates and even to demonstrate safety procedures to utilize. One being a ventilated and other being non-ventilated design. With a fluorescein and a salt substance, my mentors and I were able to conduct experiments to simulation a situation of exposure, mocking a patient laying down with a ventilated container overhead and other with a non-ventilated container overhead. Both options yielded different discoveries.

### Poster 105

**Presenter: Josh Wu** (Carleton College)

Mentor: Matthew Miller (Biochemistry)

*Effect of Ndc80 and Spc24 mutations on Stu2 dynamics and occupancy & Tagging Kinetochores Genes*

The basis of life depends on an organism's ability to reproduce, a bequeathment ritual of its most sacred possession: DNA. In eukaryotes, this involves the faithful segregation of duplicated chromosomes to offspring via kinetochore-microtubule attachments. Due to its highly conserved nature, the unbelievably versatile and fertile model organism yeast can be used to study the mechanisms used for chromosome segregation. Previously, we have identified a kinetochore-associated protein, Stu2, that contributes tension-dependent stabilization that is necessary and sufficient for proper segregation (Miller, Matt). Furthermore, we show that the binding site is at a C-terminal segment of Stu2 that binds to other kinetochore components, Ndc80 and Spc24 (Stewart, Michael). But Stu2 is multi-faceted, and the complete process underlying its dynamic function and occupancy with the kinetochore is still unknown. By creating mutations to hypothesized Stu2 binding sites on Ndc80 and Spc24, we hope to elucidate the function or occupancy of Stu2 further. But Stu2 is not the only kinetochore protein we care about; thus, we are tagging other kinetochore genes to potentially explore different areas of this complex protein.

### Poster 106

**Presenter: Olivia Wu** (University of Utah)

Mentor: Emily Dennis (Neurology)

*Alterations in Cerebellar Vermis Volume in Military Mild Traumatic Brain Injury*

The cerebellar vermis, located in the medial zone of the cerebellum, is thought to be responsible for movement and posture changes. Neuroimaging studies involving military patients with a traumatic brain injury have previously indicated an association between the vermis volume of the cerebellum and motor/cognitive functions. Although variations in vermis volume have been reported in several psychiatric symptoms, we wondered if the role of the vermis is limited to its regulation of locomotion or if it's also engaged in the aspects of cognition and emotional activities. We used data from the "Long-Term Impact of Military-Relevant Brain Injury Consortium Chronic Effects of Neurotrauma Consortium" (LIMBIC-CENC) to construct a comparison of different vermis volumes detailing the correlation of veteran's traumatic brain injury contribution to the vermis' size and functions. Aligning with what has already been assumed, the decrease in vermis volume is negatively correlated with several psychiatric disorders. We speculate that this correlation for the vermis atrophy and its symptoms will provide a guide to future vermis volume study.

### Poster 107

**Presenter: Sophie Wynn** (University of California San Diego)

Mentor: Steven Cooper (Atmospheric Sciences)

*Snowfall Measurement Uncertainties Over Mountainous Terrain*

Snowfall plays a vital role in shaping high-latitude climate as it responds to anthropogenic climate forcing. Unfortunately, the accurate measurement of snowfall is challenging from both traditional snow gauge and remote sensing approaches. As such, quality observations of global snowfall distributions needed to constrain climate studies are often lacking, particularly for the remote and rugged high-latitude regions. This work investigates our ability to accurately measure surface snowfall accumulations, using data collected at a mountain research station at Haukelisetter, Norway, during the NSF-funded High Latitude Measurement of Snowfall campaign. Project instrumentation included single and double-fence snow gauges, a Micro-Rain Radar, and a Multi-Angle Snow Camera to estimate snowfall properties as a function of basic meteorological conditions, e.g. wind speed and temperature. For these studies, double-fence gauge observations of

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snowfall were considered 'truth' for validation purposes. The collection efficiency of the single-fence snow gauges, which are widely employed as the primary snow gauge measurement at most meteorological stations, were found to vary with wind speed, snowfall regime, and precipitation microphysics. For example, collection efficiency values of 65, 36, and 28% were found for wind speed values of 0-4, 4-8, and 8-12 m/s, respectively. Project data was also used to derive the first known relationship between radar reflectivity and surface snowfall rate (Z-S) for the Haukeliseter site. This relationship for Haukeliseter, which rests in the coastal mountains of Norway and often generates heavily-rimed precipitation, was contrasted with previously-published Z-S relationships derived for locations dominated by dry snowfall. These calculated differences in snowfall derived from the multiple Z-S relationships support the importance of understanding unique snowfall regime-dependent microphysics for the accurate estimate of snowfall from radar observations.

### Poster 108

**Presenters:** Gabriel Baffour (University of Utah) and Jessica Cuello (University of Utah)

Mentor: Daniel Mendoza (Atmospheric Sciences)

*Electric Bus Air Quality Monitoring Platform: Findings and Implications*

In Salt Lake City, a unique air quality remote-sensing system developed and is used for air quality simulations allowing the public to view the harmful effects of regional air quality pollution in the Salt Lake Valley Region. This study focuses on integrating air quality sensors on (Utah Transit Authority) UTA and electrical buses for public transportation throughout the Salt Lake Region stretching as far south as Draper, UT, and as far north as Ogden, UT. These sensors pick up trails of Ozone, NO<sub>2</sub>, and CO<sub>2</sub> within our troposphere. The effect these pollutants have on human health is extremely detrimental after a certain period of time, as well as induces respiratory diseases. With the aid of Utah's light rail or TRAX system, it allows for compiling data on the concentration of particulate matter with a diameter of <10 µm (PM<sub>10</sub>) around the valley region by using The Air Pollution Model. Through the use of the Air Pollution Model, forecasts can be constructed to indicate the result of different health risk patterns and pollution hot spots. Through the vast system of air quality network data, collecting and analyzing the data allows for the inquiry of recent inversions in the air caused by PM<sub>2.5</sub> levels exceeding the National Ambient Air Quality Standard (NAAQS). In similarity, researchers have conducted a study in which a local news helicopter was in use to provide a sensor platform for spatial-temporal analysis & vertical profiles of pollution concentration in the Salt Lake Valley. In parallel, the air quality data gained by the news helicopter was disseminated from maps, websites, forecasting trends as well as public awareness. (2015-2016). Facing the increasing threat of a risk to public health through pollutants traveling through the air, it is uncertain the future of air quality, despite ensuring to limit the concentration of ozone and gas emissions.

### Poster 109

**Presenter:** Keaton Rosquist (University of Utah)

Mentor: Anandh Velayutham (Nutrition and Integrative Physiology)

*Blueberry Supplementation Improves High-fat-diet Induced Gut Inflammation*

*Background:* Obesity has currently been a growing health concern that has ranged across the world. Diet-induced obesity drives gut inflammation through the production of cytokines and alteration in gut microbiota. High fat diet (HFD) favors the conditions that lead to gut inflammation with an increased gut epithelial permeability that allows for higher chances of gastrointestinal disorders occurring. Antibiotics usage interrupt the gut symbiosis and further exacerbates HFD-induced complications. Evidence indicates HFD with antibiotics increases the risk of pre-inflammatory bowel disease (IBD). Blueberries contain bioactive flavonoid compounds called anthocyanins which possesses antioxidant and anti-inflammatory properties. In the present study, we assessed whether dietary blueberry improves HFD- and antibiotics-induced gut inflammation.

*Methods:* Male C57BL/6J mice (7 weeks old) were divided into three groups: (1) control mice consumed standard diet (C), (2) mice consumed HFD and treated with antibiotics in drinking water (HFA), (3) mice consumed blueberry supplemented HFD and treated with antibiotics (HFAB) for 12 weeks. Gut inflammation was assessed by measuring the mRNA expression of inflammatory markers (IL-1 $\beta$ , IL-6, iNOS and MCP-1) using qPCR. The total RNA was isolated from colon using RNeasy plus mini kit, cDNA was synthesized using RT-PCR kit, and the expression of inflammatory molecules was measured with qPCR by using SYBR green (Qiagen).

*Results & Discussion:* The mRNA expression of inflammatory markers IL-1 $\beta$ , iNOS and MCP-1 were significantly increased in HFA vs C mice. However, dietary supplementation of blueberry significantly reduced the expression of IL-1 $\beta$ , iNOS and MCP-1 indicating the beneficial effect of blueberries on gut. The mRNA expression of IL-6 was similar among the groups. Our ongoing studies are focused on identifying the molecular mechanisms involved in the protective effect of blueberries. Our study suggests consumption of blueberry may be a potential dietary approach to improve gut health.



